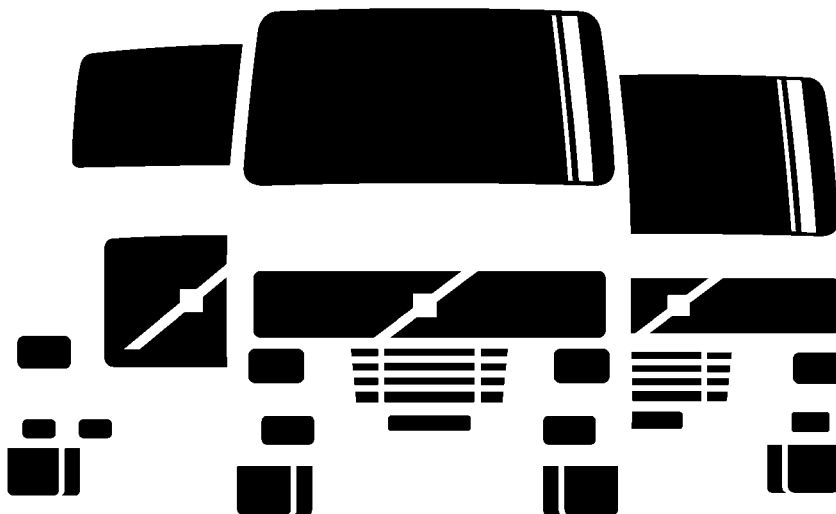


Service Manual Trucks

Group **300–500**
Electrical General
VN from 2/98
and VHD



Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to April 2004.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an V.S.T. (Volvo Standard Times).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an V.S.T.

Each section of this manual contains specific safety information and warnings which must be reviewed before performing any procedure. If a printed copy of a procedure is made, be sure to also make a printed copy of the safety information and warnings that relate to that procedure. The following levels of observations, cautions and warnings are used in this Service Documentation:

Note: Indicates a situation, handling or circumstance which should be observed.

Caution: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage to property.

Warning: Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or major damage to property.

Danger: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-20 007111

Repl: This Service Manual replaces Service Manual, "Electrical General, VN from 2/98 and VHD" (08.2000), publication number PV776-TSP145645.

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Operation Numbers

General

General Information

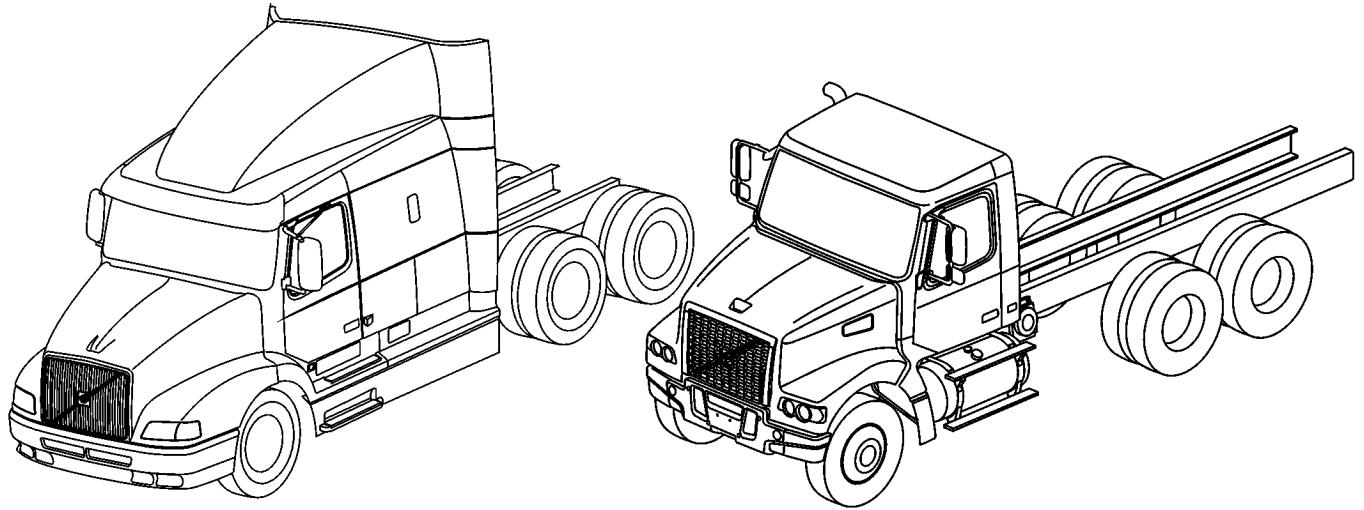


Fig. 1: VN and VHD Models

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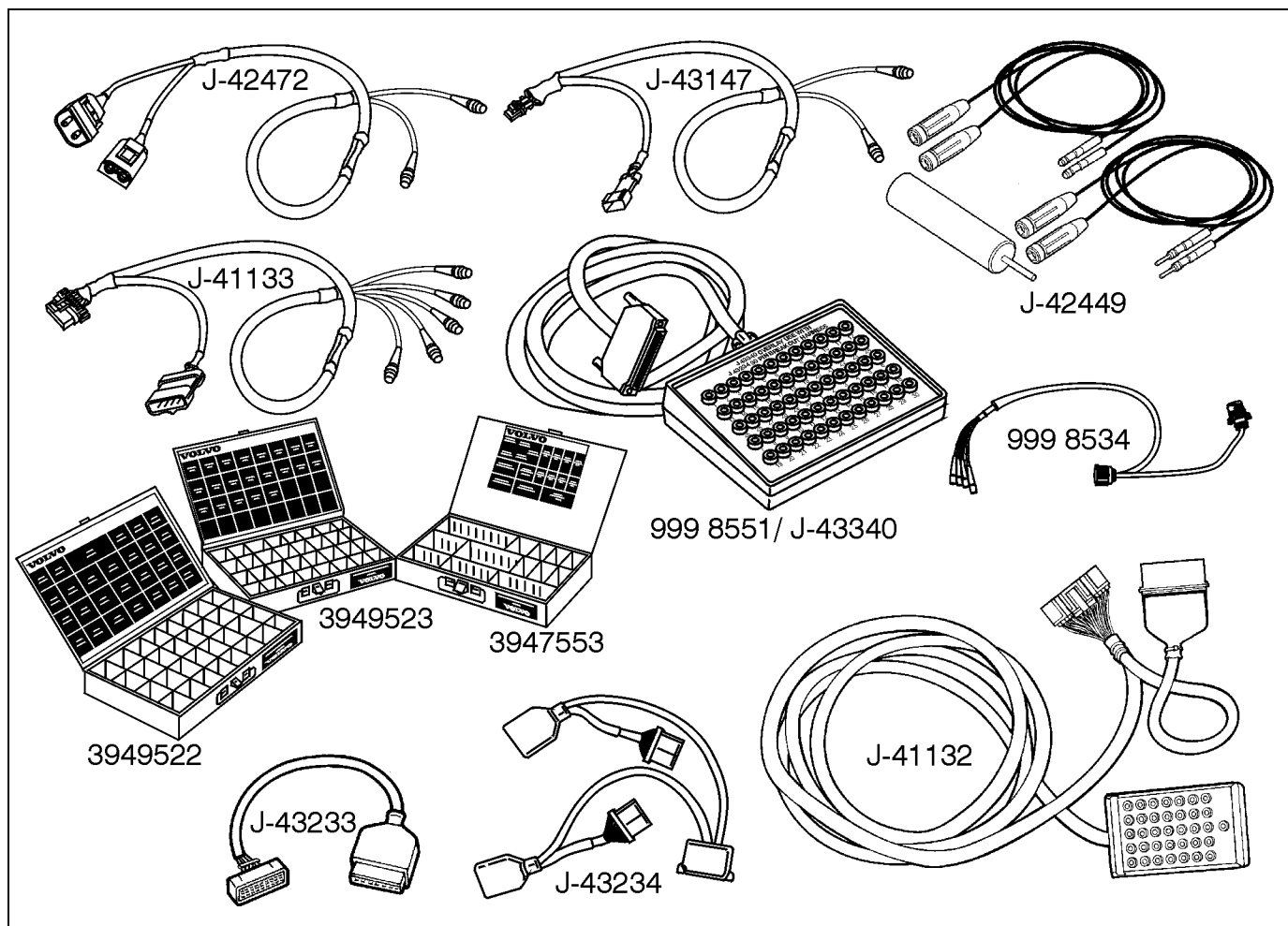
This information covers electrical features of VHD vehicles, and VN vehicles built from February 1998. It includes information about major cab electrical components, circuit types, controls, connectors and the tools commonly used for maintenance.

For vehicle-specific electrical wiring, refer to the VN and VHD electrical schematics in Group 37.

Tools

Special Tools

The following special tools may be needed when troubleshooting wiring and connectors. The tools can be ordered from Kent-Moore (800-328-6657) or Volvo, as indicated.



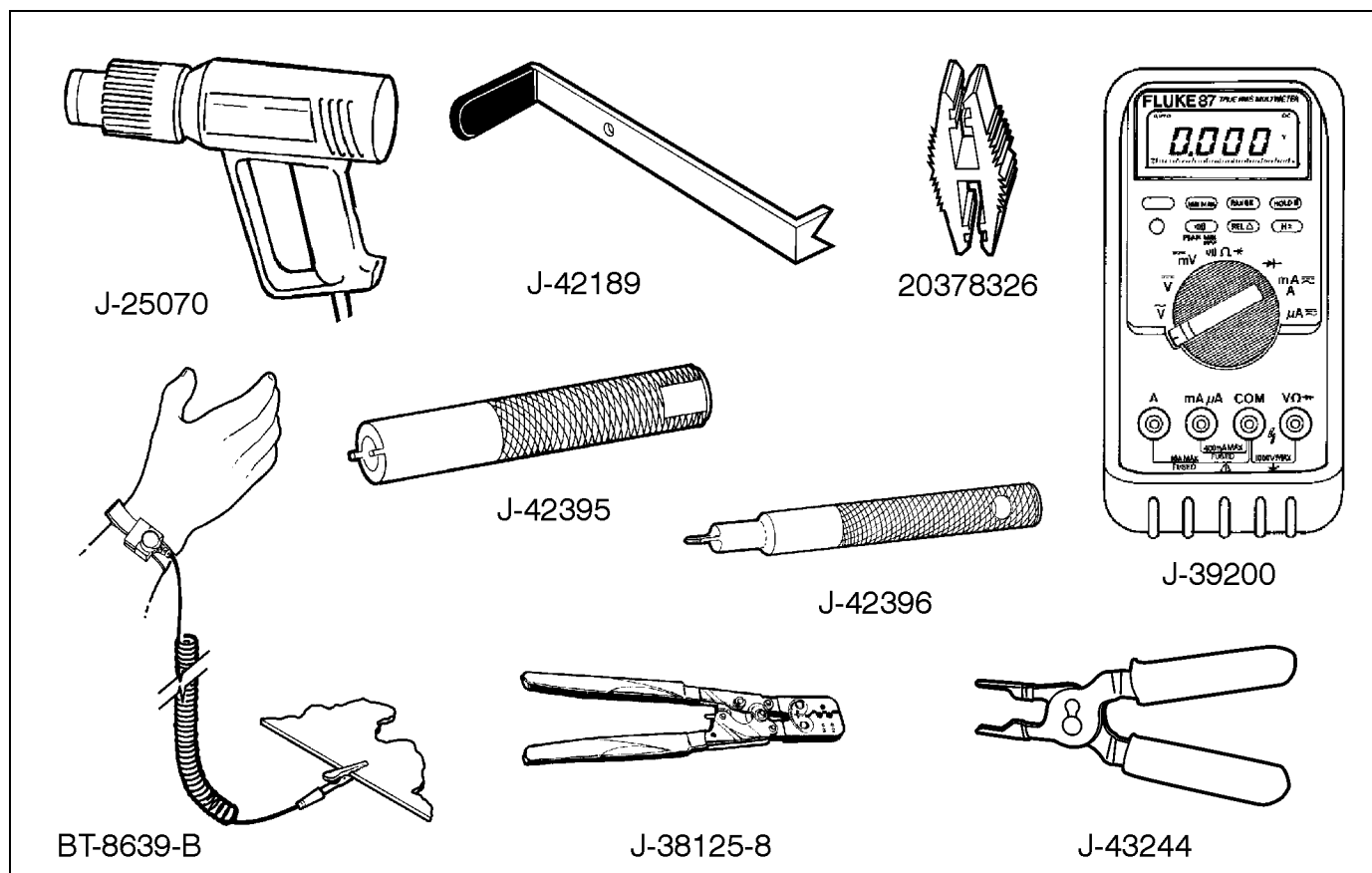
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Fig. 2: Special Tools

J-42472	2-pin Breakout Harness (Kent-Moore)	9998551	60-pin Breakout Box (Volvo)
J-41133	5-pin Breakout Harness (Kent-Moore)	J-43340	Overlay for 60-pin Breakout Box (Kent-Moore)
J-43147	2-pin Breakout Harness (Kent-Moore)	9998534	4-pin Breakout Harness (Volvo)
J-42449	JAE Terminal Removal and Probe Kit (Kent-Moore)	J-43233	36-pin Jumper Harness (Kent-Moore)
3949522	VN Cab Terminal Kit (Volvo)	J-43234	Adapter (Kent-Moore)
3949523	VN Chassis Terminal Kit (Volvo)	J-41132	36-pin Breakout Box (Kent-Moore)
3947553	D12 Engine Harness Terminals (Volvo)		

Special Equipment

The following items can be ordered from the vendors listed.



W0001909

Fig. 3: Special Equipment

J-25070	Heat Gun (Kent-Moore)
J-42189	Air Line Removal Tool (Kent-Moore)
J-39200	Fluke 87 Digital Multimeter (Kent-Moore)
BT-8639-B	Anti-Static Wrist Strap (Kent-Moore)
J-42395	Rheostat Removal Tool (Kent-Moore)
20378326	Fuse Puller Tool (Volvo)
J-42396	Window/Mirror Switch Removal Tool (Kent-Moore)
J-38125-8	Packard Crimper (Kent-Moore)
J-43244	Relay Puller Tool (Kent-Moore)

Design and Function

Electrical General

- [“Typical Circuit Components” page 10](#)
- [“Data Link Communication” page 13](#)
- [“Starting and Charging System” page 17](#)
- [“Fuse and Relay Locations” page 32](#)
- [“Switches and Controls” page 36](#)
- [“Instrumentation” page 52](#)
- [“Lighting System” page 53](#)
- [“Supplemental Restraint System” page 54](#)
- [“Vehicle ECU” page 55](#)
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- [“Horn” page 59](#)
- [“Bodybuilder Wiring” page 63](#)

Typical Circuit Components

Wiring Harnesses, Wires & Connectors

Each circuit uses a wire of a specific size, based on the current demands for that circuit. The circuit number is stamped into the insulation every 76 mm (3 in.). This aids in proper connections and simplifies circuit tracing.

Black, numbered wires are fused, powered circuits. White wires are ground. Red wires are "hot" at all times and protected by fusible links. Multi-colored wire harnesses may be used as interfaces to some components; the definition of those multi-colored wires varies by component.

Some wires are grouped together and encased in a split plastic casing or braided tubing called a conduit. This grouping of wires is called a harness. Major wiring harnesses are joined by using multiple plug and receptacle connectors.

Each harness or wire must be held securely in place by clips or other holding devices to prevent chafing of the insulation.

Terminals used throughout the system are Deutsch, Amp, JAE, KOSTAL and Packard.

Wiring Schematics

The wiring schematics for VN/VHD series vehicles are found in "VN or VHD Series Electrical Schematics, Group 37." These schematics are continuously updated to provide detailed, vehicle-specific wiring information. Detailed instructions for schematic use is included in these binders. The schematics feature:

- Single circuit format
- Illustrated location of connectors on the vehicle
- Connector cavity, circuit and function details
- Fuse numbers
- Wire numbers
- Splice details
- Vehicle variant details

Simplified schematics are sometimes used in manuals and bulletins to help explain component design and function features or to clarify troubleshooting instructions. These simplified schematics do not offer the level of detail needed for vehicle troubleshooting, nor are they updated regularly. Always use the schematics found in "VN/VHD Series Electrical Schematics, Group 37" for the most current information.

Circuit Protection

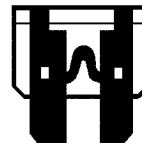
To protect wiring and equipment from overloads, circuit protectors, such as fuses, are used. Circuit breakers and fusible links are also used.



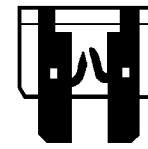
CAUTION

Failure to use proper circuit protection devices in the vehicle can result in damage to the vehicle and its components. Replace blown fuses only with fuses of the same rating. Replace fusible links only with proper replacement parts of the exact gauge and length. Failure to use proper circuit protection could overload the circuit, causing severe damage to the vehicle.

Fuses



①



②

W3000484

Fig. 4: Blade-type Fuses

- 1 Good fuse
- 2 Blown fuse

The most common protector in the vehicle circuit is a fuse. A fuse consists of a fine wire or strip of metal inside a glass tube or, more commonly, in a plastic housing. The strip melts and interrupts the flow of current in the circuit when there is an overload caused by an unwanted short or ground. The fuse is designed to melt before the wiring or electrical components in a circuit can be damaged. Naturally, the cause must be located or the new fuse will also blow. Since different circuits handle different amounts of current, fuses of various ratings are used. Be sure to replace a blown fuse with a fuse of the same rating.

The VN/VHD vehicles use maxi-fuses, which are designed for a larger amount of current than a regular fuse. Mini-fuses are also used. They are smaller in size, but their current ratings are the same as ATO blade-type fuses.

Fusible Links

Fusible links are used to protect high-current circuits against current overload when there is a short to ground. The fusible link is a short length of wire that is smaller in gauge than the wire in the protected circuit. In the event of an overload the fusible link will melt, breaking the circuit and preventing damage to the electrical system. If a fusible link does open, special attention must be paid to finding and repairing the cause.

Fusible links are used in two locations: two are at the starter motor on the positive side feeding the cab main power studs, and one is from ground on the starter motor to engine ground. The fusible links on the positive side are 10 gauge cables 120 mm (4.72 in.) in length. On the ground side, it is an 8 gauge cable.

Diodes

Diodes are used on many of the vehicle's circuits to protect and isolate them from voltage surges, which can occur when a circuit is turned off. Diodes allow voltage to flow in one direction only, like a one-way check valve.

Circuit Breakers

Circuit breakers are optional equipment. SAE Type 2 modified reset circuit breakers are the only type of circuit breakers approved for use in VN/VHD vehicles. They may be used on accessory and ignition circuits only. Circuit breakers protect a circuit from overload. When an overload (high current flow) occurs in a circuit, a bimetallic strip in the breaker is heated. This opens its contact, temporarily breaking the circuit. When this bimetallic strip cools down, it remakes the contact.

Type 2 circuit breakers are opened by current overload and remain open as long as the power is on. A Type 2 circuit breaker keeps the bimetallic strip hot after tripping by diverting a small amount of current through a small coil of resistance wire. If power to the circuit breaker is switched off long enough for the bimetallic strip and resistance wire to cool down, the breaker will automatically reset.

When any circuit breaker trips, it should be viewed as an indication of a possible fault in the circuit. Every effort should be made to identify and correct the fault if one exists.

Switches and Relays

Circuit controls are switches or relays. Switches are usually at the beginning of a circuit but can be used to control a ground path. For example, the switch controlling the headlights is at the power end of the circuit, while the door switch controlling the dome light completes the circuit to ground. Relays are remotely controlled switches. They use a low current signal through a coil to control larger currents conducted through their contacts.

VN Series vehicle circuits also include micro-relays. The micro-relay is smaller in size than a conventional relay, and the pin arrangement is different (see illustration).

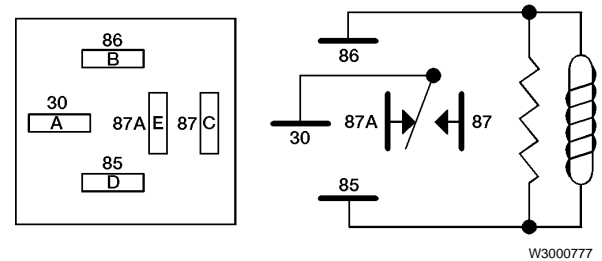


Fig. 5: Relay Pin Arrangement and Schematic

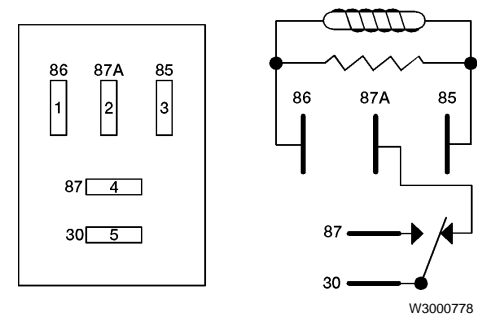


Fig. 6: Micro-relay Pin Arrangement and Schematic

Note: Relays are shown from insertion-side view.

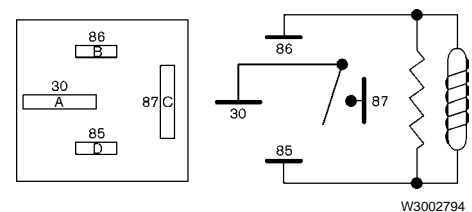


Fig. 7: Power Relay Pin Arrangement and Schematic

Sensors and Senders

Many electronic signals used by ECUs and the instrument cluster are supplied by sensors and senders. A sensor or sender sends a signal to a control unit, or to the microprocessor in the instrument cluster. Sensors used in the vehicle system include the vehicle speed sensor, the throttle position sensor and Anti-lock Brake System (ABS) wheel speed sensors.

The vehicle speed sensor is mounted in the transmission and reads the movement of the teeth on the output shaft. It is of an inductive type and sends a fluctuating (sinusoidal) signal to the engine ECU.

The fuel sender, mounted in the fuel tank, transmits the fuel level to the instrument cluster.

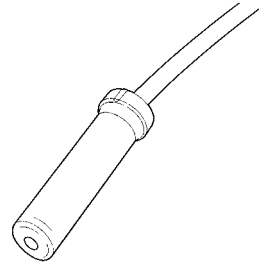
An Anti-lock Brake System (ABS) wheel speed sensor is mounted in each monitored wheel. As the wheel spins, the sensor sends a fluctuating signal to the ABS ECU, which the ECU interprets as wheel speed.

VN and VHD vehicles are equipped with combination sensors that can measure both pressure and temperature of certain engine functions.

The turbo boost temperature and pressure sensor, for example, measures both the temperature and the pressure of turbo boost air in the intake manifold. A capacitive type sensor measures the pressure of the turbo boost and sends a signal to the Engine ECU, which interprets this pressure and adjusts engine functions accordingly.

The sensor's temperature element is a thermistor type that creates a resistance from the temperature of the turbo boost air and also sends a signal to the engine ECU.

The combination engine oil temperature and pressure sensor functions identically, but sends engine oil information first to the Engine ECU, then to gauges on the instrument cluster via the Data Link wires.



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Fig. 8: Anti-lock Brake Wheel Speed Sensor

Data Link Communication

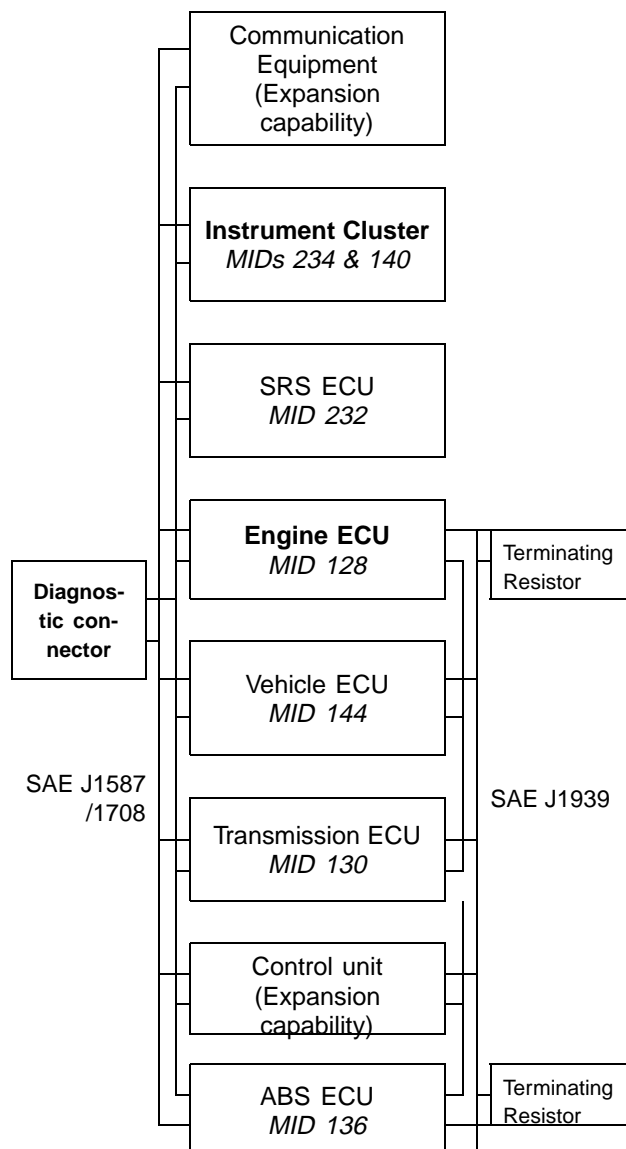
General

Communication between the different ECUs takes place via the two data links: the J1939 control data link and the J1587/1708 information data link.

The diagram shows how the control units, the diagnostic connector, and the instrument cluster are connected in principle.

The instrument cluster, the engine ECU and the diagnostic connector are always included in the system. The system may include other control units, depending on the vehicle type, engine type and optional equipment.

An overview of data link communication follows. For complete information on data link communications, see “*Vehicle Electronics, Design and Function*” Volvo publication number PV776–TSP132163.



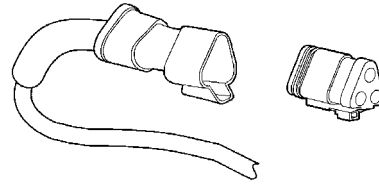
SAE J1939 Control Data Link

The system's **control signals** are sent via this link.

The J1939 link is very fast, operating at 250,000 bits per second. This operating speed allows the system to function more effectively and adapt quickly to changing conditions and vehicle requirements.

The link complies with SAE standards, and consists of three twisted wires: a green wire (407), a yellow wire (406) and a shield wire (408). The twisted wire set (40 turns per meter) is used to protect the link from electrical interference.

Note: The shield wire (408) may not be present in some vehicles.



W3002905

Fig. 9: J1939 Terminating Resistor



CAUTION

No modifications or connections should be made to wires 406 (yellow), 407 (green) or 408 (shielded). These wires carry the high-speed communications between the electronic systems in the vehicle. **Any modification, connection to, or damage to these wires can result in the failure of the vehicle's electronic systems.**

Terminating Resistor

Terminating resistors are wired into each end of the J1939 data link. One is located near the ABS ECU and the other near the engine ECU. On Volvo engines, the terminating resistor at the engine ECU end is located inside the EECU.

Only two terminating resistors are used in a vehicle. Never install three in one truck. If more than two terminating resistors exist in the J1939 circuit, damage to the ECU electronics can occur over time. You can easily check to see if you have two resistors by measuring the resistance between circuits 406 and 407 with the ignition OFF. The correct resistance is 60Ω .

The purpose of these resistors is to prevent data link signal reflections. They must remain connected for the system to function properly.

SAE J1587/1708 Information Data Link

Information and diagnostic signals are sent via this link. The link also functions as a “backup” should the J1939 control data link fail to function for any reason.

SAE J1708 is a standard that specifies hardware and a databus speed of 9600 bits per second. SAE J1587 is a protocol that provides a standard method for exchanging information between microprocessors.

The J1587 link consists of two wires (400 and 401) that are twisted around each other approx. 30 turns per meter. The twisted-pair wires are to protect the link against electrical interference.



CAUTION

If a circuit must be added to the electrical system, and will carry high currents or frequencies, route it in a location AWAY from wires 400 and 401 to prevent mutual inductance from interfering with data link functions.



CAUTION

Wires 400 and 401 **MUST NOT** be cut or spliced for any connections. These wires are used for the transmission of data for diagnostic messages and gauges. Modifying this circuit can cause these functions to fail.

SAE J1922 Data Link

For a short period of time some vehicles were produced which used the J1922 data link. The J1922 data link was developed as an interim standard until the J1939 control data link was established. The J1922 link operates on J1708 defined hardware and is used like a control link for communication between engine, transmission and ABS ECUs.

The J1922 link consists of two wires (404 and 405) that are twisted around each other approx. 30 turns per meter. The twisted-pair wires are to protect the link against electrical interference.

Diagnostic Connector

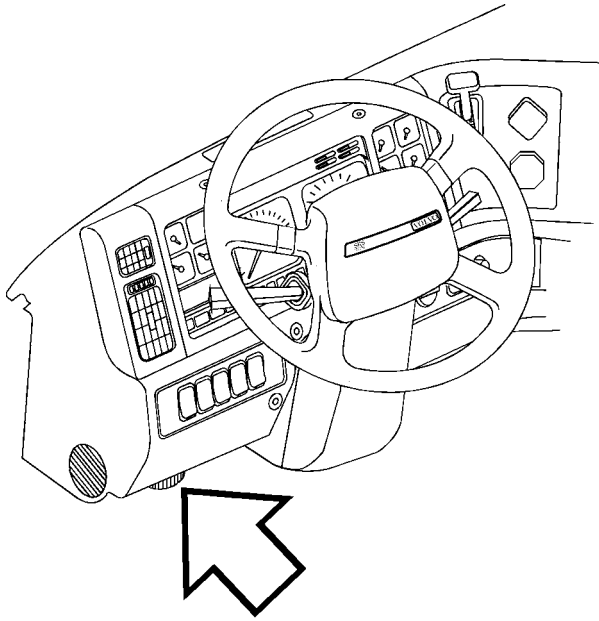


Fig. 10: Diagnostic Connector

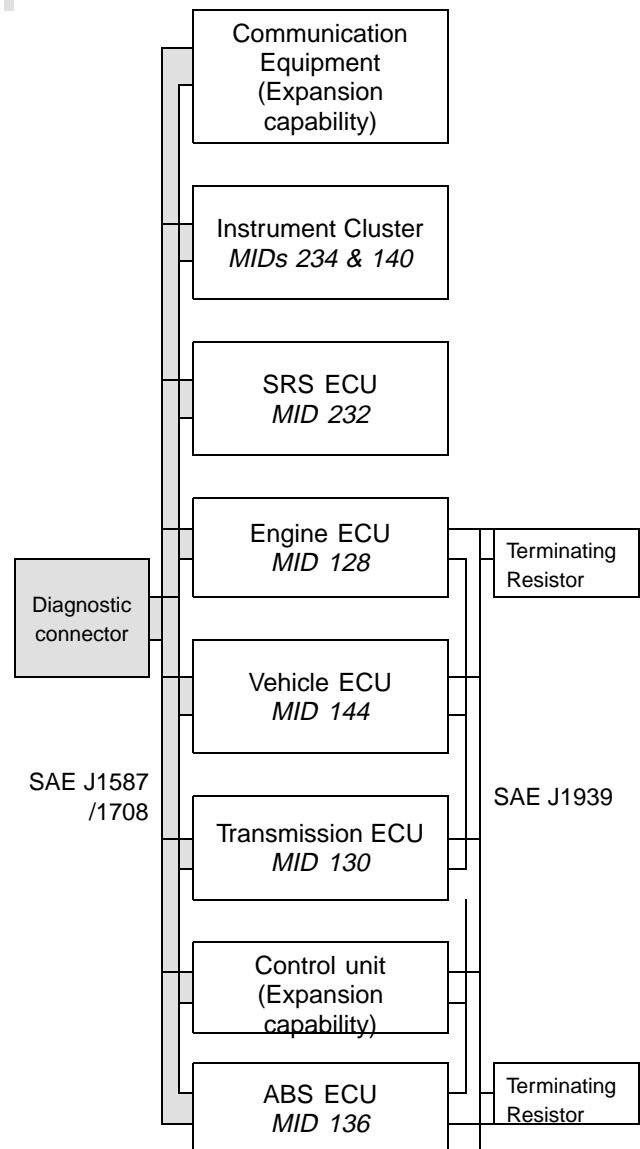
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The diagnostic connector is a round Deutsch connector located in the driver's side kick panel. The diagnostic connector is connected to the J1587/1708 information link and gives the system a way to communicate with an external PC or diagnostic tool.

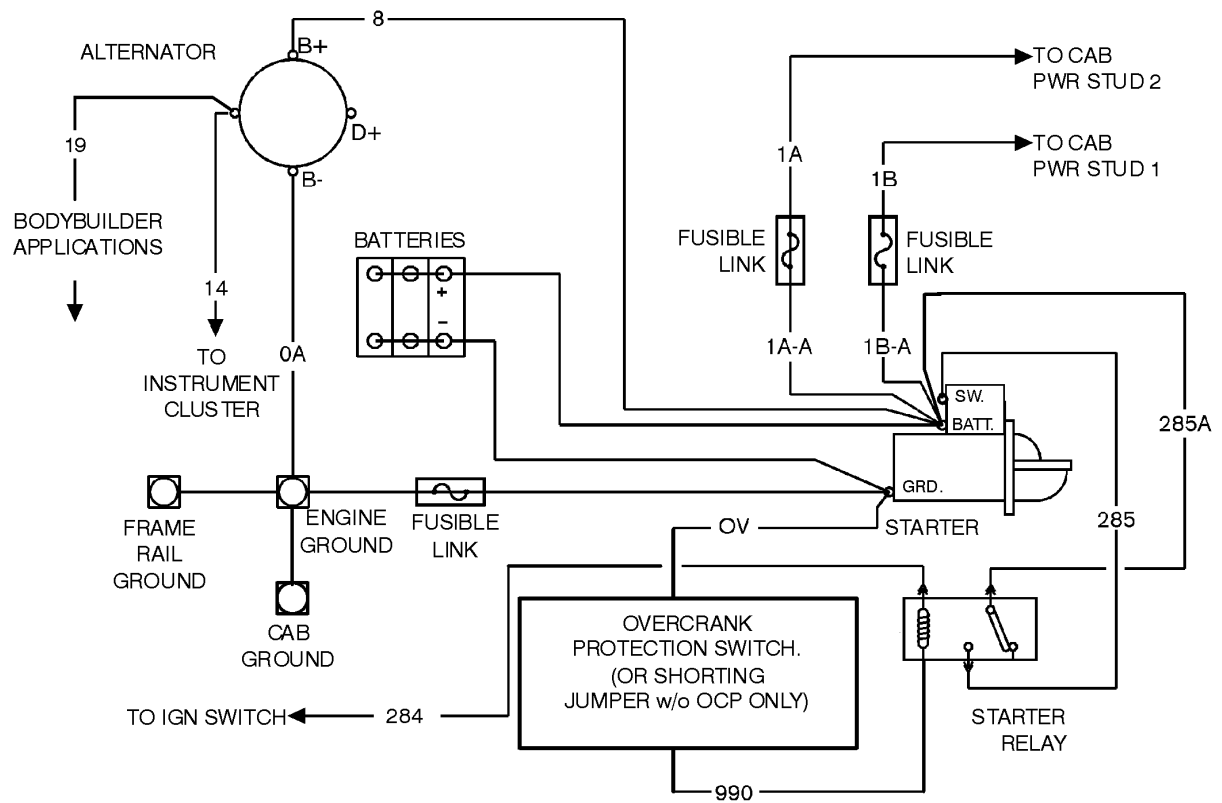
With a PC or diagnostic tool connected, error codes can be read from all the control units. This is important in fault tracing to carry out basic checks of all the vital parts of the vehicle's electronics.

Some programming can also be done via the diagnostic connector.

The standard diagnostic connector is a 6-pin Deutsch. A newer 9-pin Deutsch version has been introduced on certain vehicle/engine variants. The new 9-pin connector connects to both the J1939 and J1587/1708 data links.



Starting and Charging System



W3004350

Fig. 11: Starting & Charging Circuit, Simplified Schematic

This simplified schematic should only be used to clarify the design features of the VN/VHD starting and charging circuit. For detailed, vehicle-specific schematics, see the "VN or VHD Electrical Schematics, Group 37."

Batteries

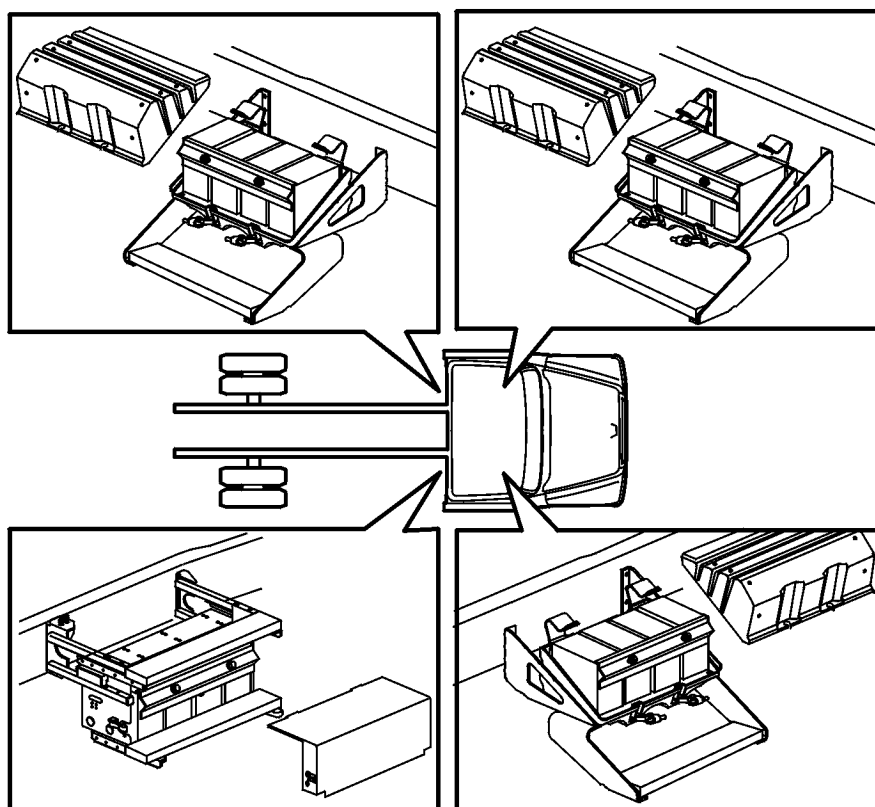


Fig. 12: Typical Battery Box Locations

W3004394

VN/VHD generally will use groups of three or four 12-volt batteries. All batteries are wired in series with the battery cables going directly to the starter. There are no “frame rail grounds” that go directly to the battery set. Battery box locations vary per application. The VN series and some VHD models have the battery box on the left frame rail under the cab steps.

As an option, some vehicles may have a master battery disconnect switch (main switch). The switch will be mounted on or near the battery box in all applications. The battery disconnect switch can be used to cut all positive battery power to the vehicle. Note: The battery disconnect switch should not be used as a substitute for removing battery cables to prevent damage to the vehicle when welding.

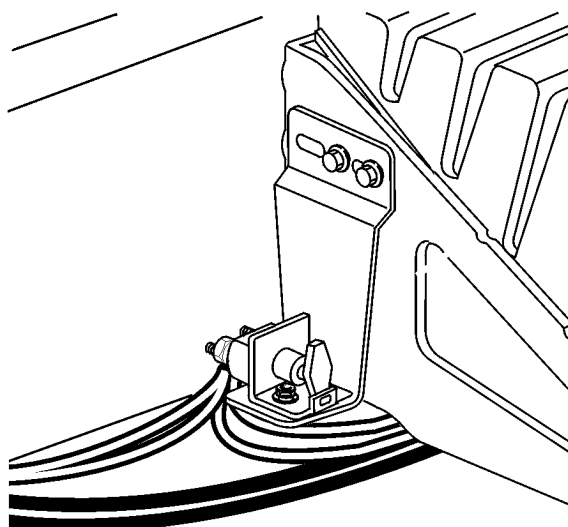


Fig. 13: Battery Disconnect Switch

W3004404

Starting Circuit

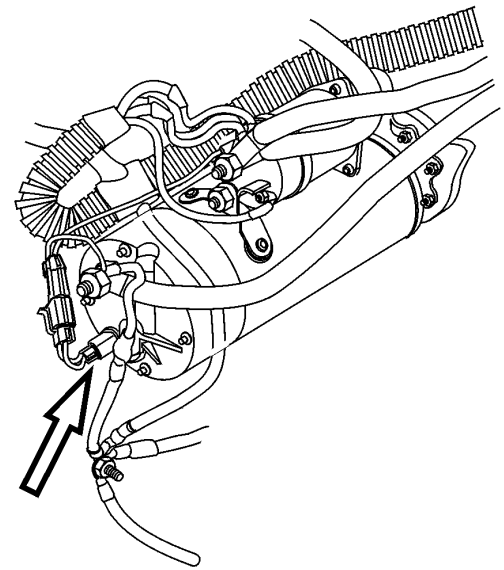
When the ignition switch is turned to the START position, power to energize the starter relay coil is supplied on wire number 284. The starter relay coil is grounded through the overcrank protection switch (or a shorting jumper).

The overcrank protection (OCP) switch is located inside the starter. This switch is optional. Where the OCP switch is not used, a shorting jumper is used to complete the starter relay coil ground circuit.

The OCP switch is designed to open and prevent the starter from turning if the starter becomes excessively hot. It should reset when the starter cools sufficiently.

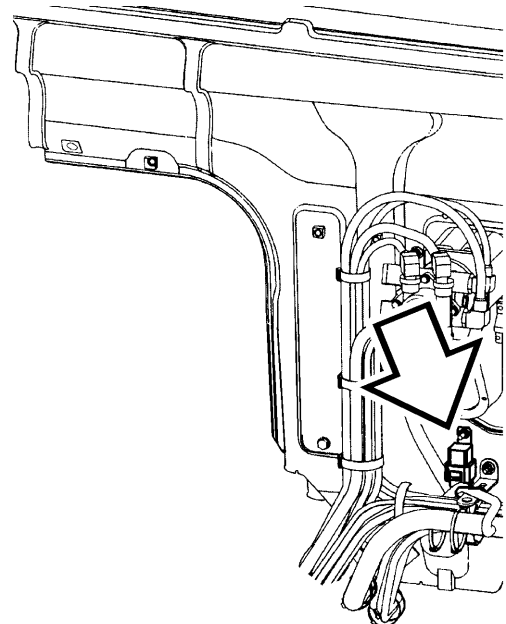
When the starter relay energizes, a connection is made from the starter solenoid BATT terminal (wire 285A) to the starter solenoid SW terminal (wire 285).

When the solenoid pulls in, a connection is made internally in the solenoid that connects the battery terminal to the motor terminal. Then the starter begins to crank the engine. See Fig. 11: Starting & Charging Circuit, Simplified Schematic page 17.



W3004339

Fig. 14: Overcrank Protection (OCP) Switch



W3003757

Fig. 15: Starter Relay

Charging Circuit

With the engine running, AC voltage is initially generated in the alternator's stator windings by passing magnetic fields from the rotor.

Diodes in the rectifier bridge change the AC voltage to DC voltage at the alternator B+ terminal.

As the alternator speed increases, current is provided for charging the batteries and operating electrical accessories through wire 8.

An integral voltage regulator maintains operating voltage to a predetermined setting. See Fig. 11: Starting & Charging Circuit, Simplified Schematic page 17.

Battery Power Supply

Power is supplied from the batteries to the starter solenoid, then from the starter solenoid battery post via wires 1A–A and 1B–A. (Note that each of these wires contains a fusible link.) Wire 1B feeds cab main power stud 1, and 1A feeds cab main power stud 2.



CAUTION

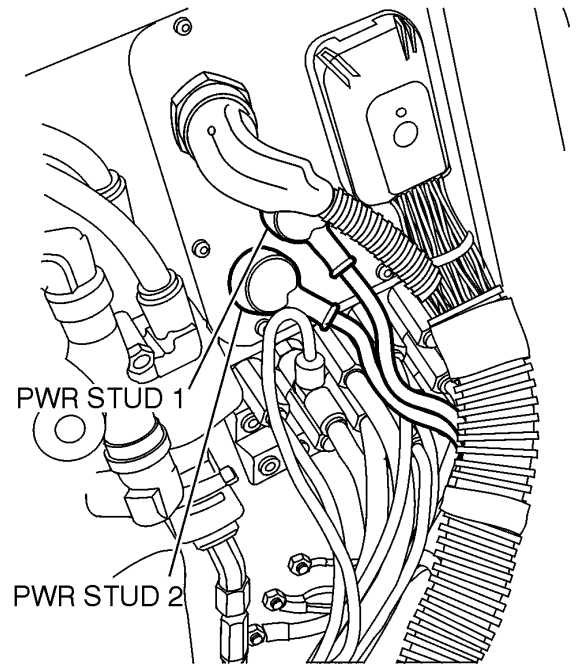
The ignition and battery expansion blocks were designed for plug-in harnesses or fuses only. **DO NOT** plug ATO-size fuses or circuit breakers into either expansion block. These devices will short the power point to the ground bus.



CAUTION

Failure to properly install additional electrical components may adversely affect the operation of the vehicle, including the engine, electrical charging system, truck body, stereo system and the driver information systems.

- Power stud 1 feeds wires 1B and 1P, which power maxi-fuse bus bars. These maxi-fuses supply power to various fuses and possibly a battery expansion block. Battery power is also supplied to the ignition switch through this circuit. The battery power expansion block is used to supply power to optional electrical accessories.
- Power stud 2 feeds wire 1A, which delivers power through a splice to the **Accessory Power Relay** and to two **Ignition Power Relays**. Power stud 2 may also supply battery power for Bodybuilder applications.



W3004399

Fig. 16: Main Cab Electrical Power Studs (driver side engine compartment)

Battery Power Supply Schematic

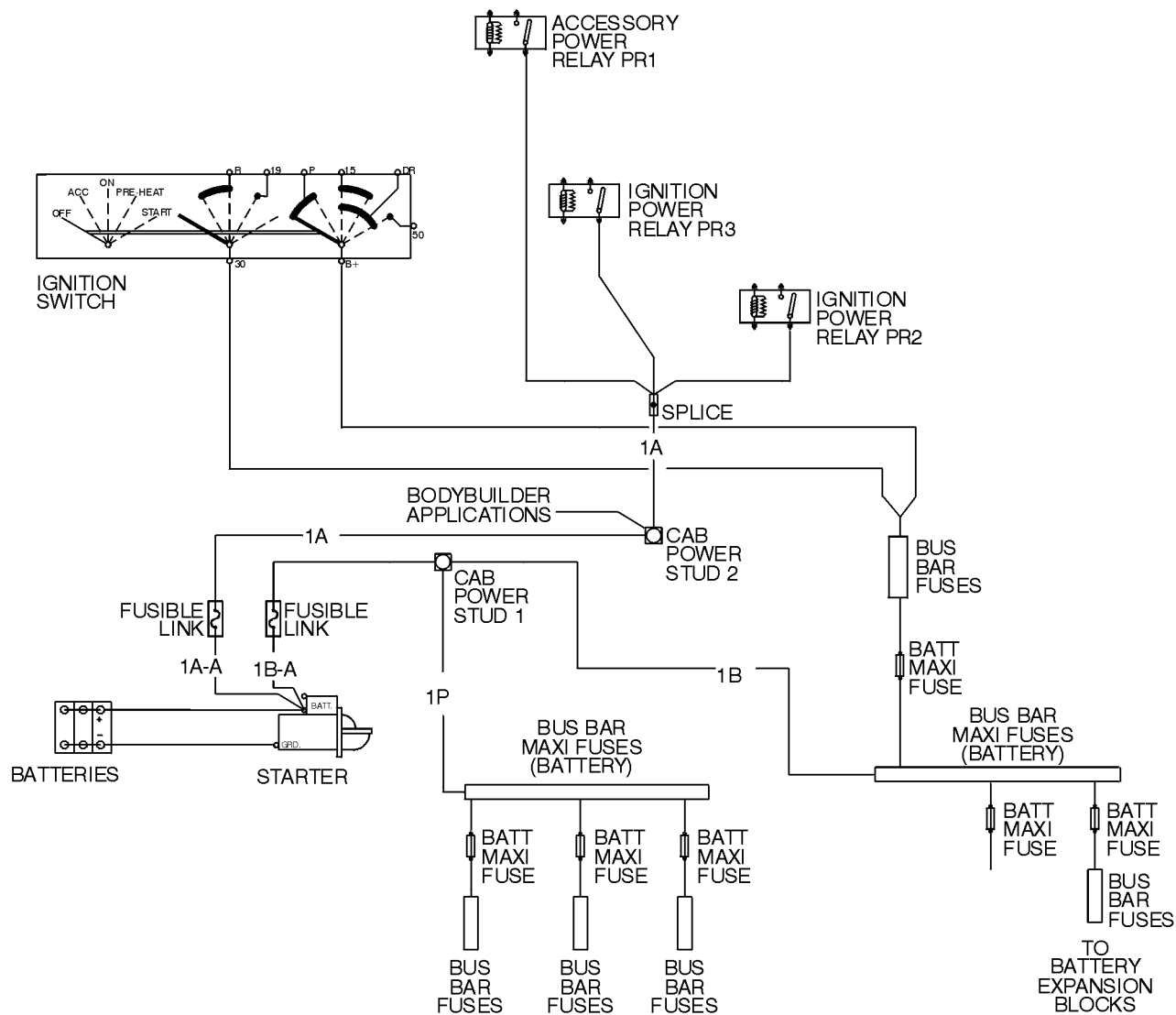
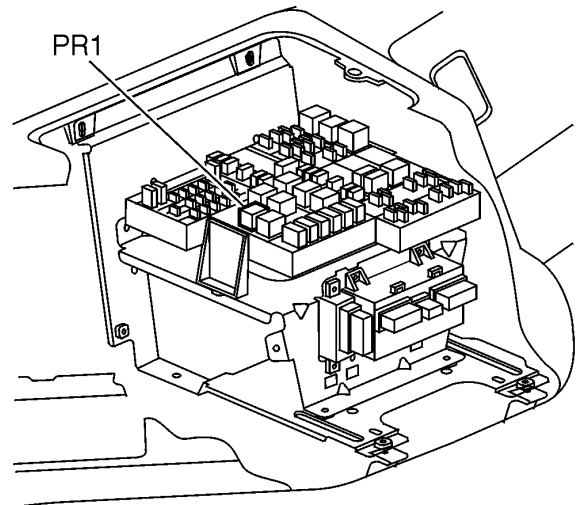


Fig. 17: Battery Power Supply: This simplified schematic should only be used to clarify the design features of the VN/VHD battery power supply circuit. For detailed, vehicle-specific schematics, see the “VN or VHD Electrical Schematics, Group 37.”

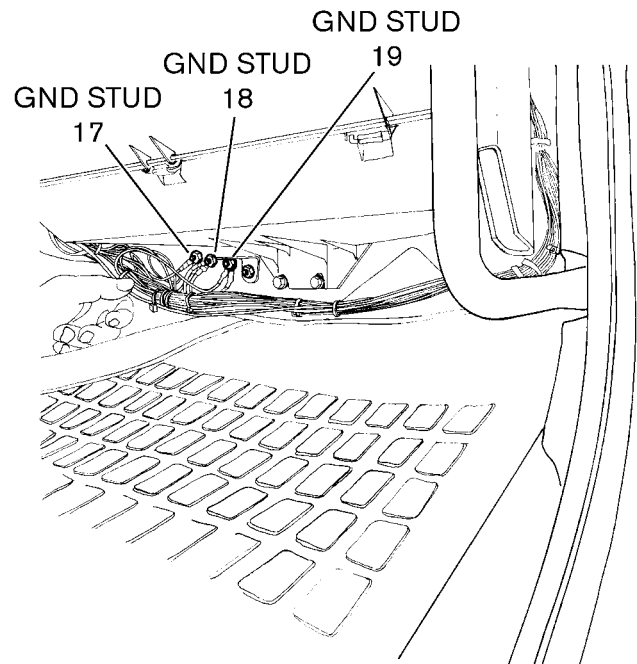
Accessory Power Supply

- Constant battery power is supplied to the ignition switch and Accessory Power Relay. See "Battery Power Supply" page 21.
- When the ignition switch is switched to the ACCESSORY position, the 195 wire energizes the **Accessory Power Relay**, PR1. The relay supplies power to wire 195A for the bus bar for Accessory fuses.
- From the Accessory Power Relay PR1, wire 0R-R provides a ground connection to the Ignition Power Relay Coil (PR2). From the Ignition Power Relay PR2, wire 0R-N provides a ground to the Ignition Power Relay Coil (PR3). From this Ignition Power Relay, the ground connection 0R-M goes to a passenger side interior ground stud (number 18 in).



W3004398

Fig. 18: Accessory Power Relay, PR1



W3002759

Fig. 19: Ground Studs (inside cab, passenger side, under heater unit)

Accessory Power Supply Schematic

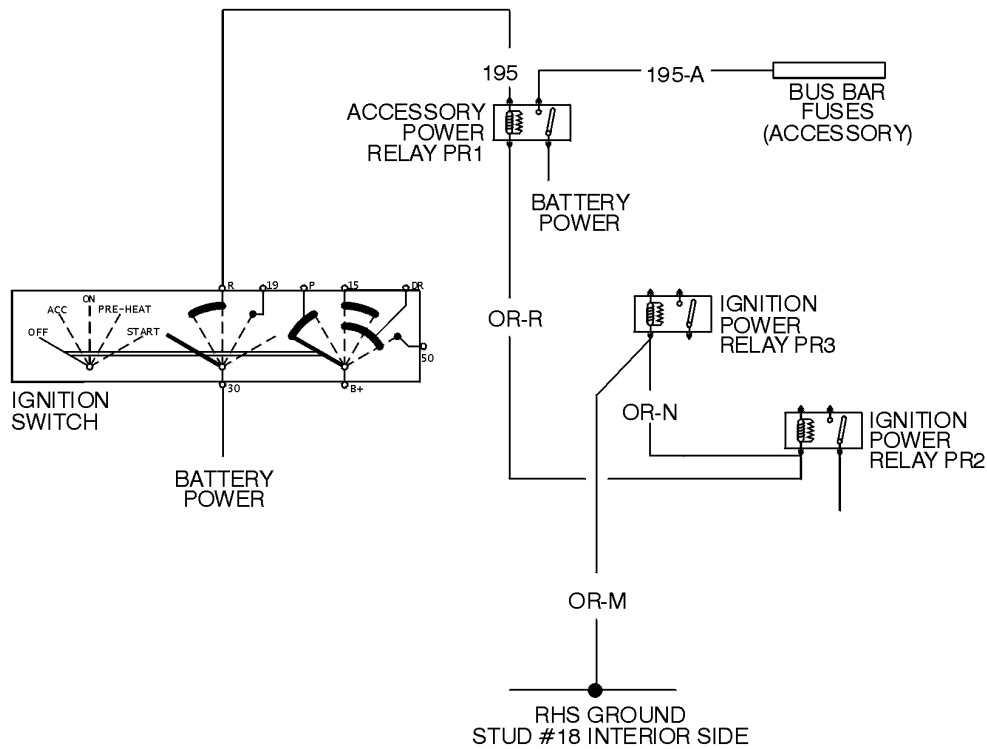
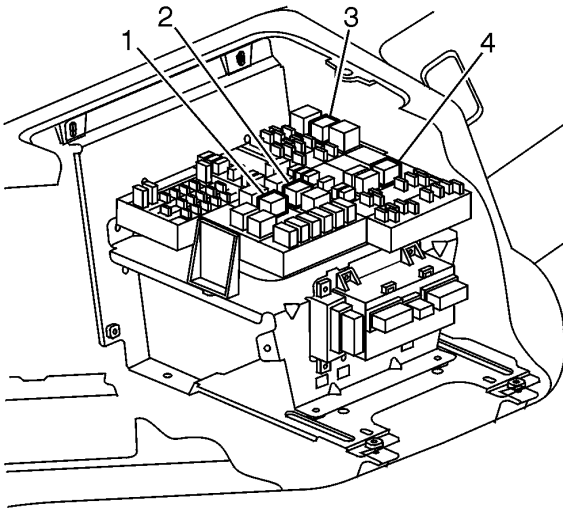


Fig. 20: Accessory Power Supply: This simplified schematic should only be used to clarify the design features of the VN/VHD accessory power supply circuit. For detailed, vehicle-specific schematics, see the “VN or VHD Electrical Schematics, Group 37.”

W3004346

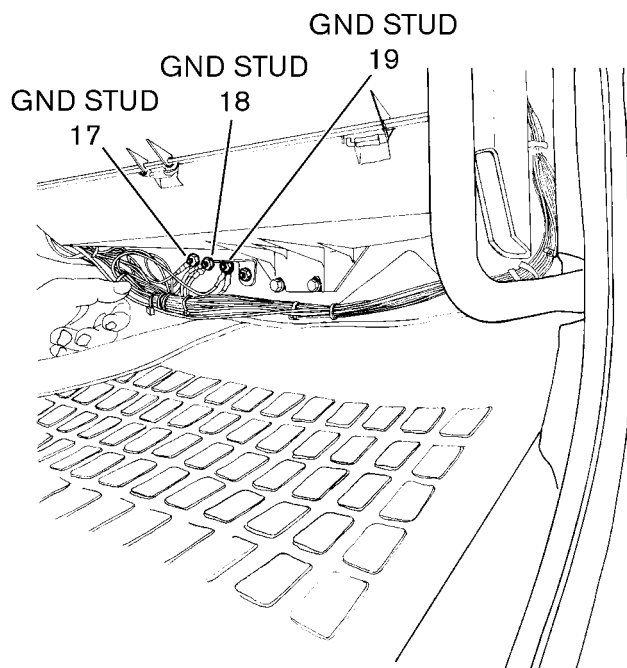
Ignition Power Supply



W3004397

Fig. 21: Ignition Power Relays

- 1 PR2
- 2 PR3
- 3 PR4
- 4 R24



W3002759

Fig. 22: Ground Studs (inside cab, passenger side, under heater unit)

CAUTION

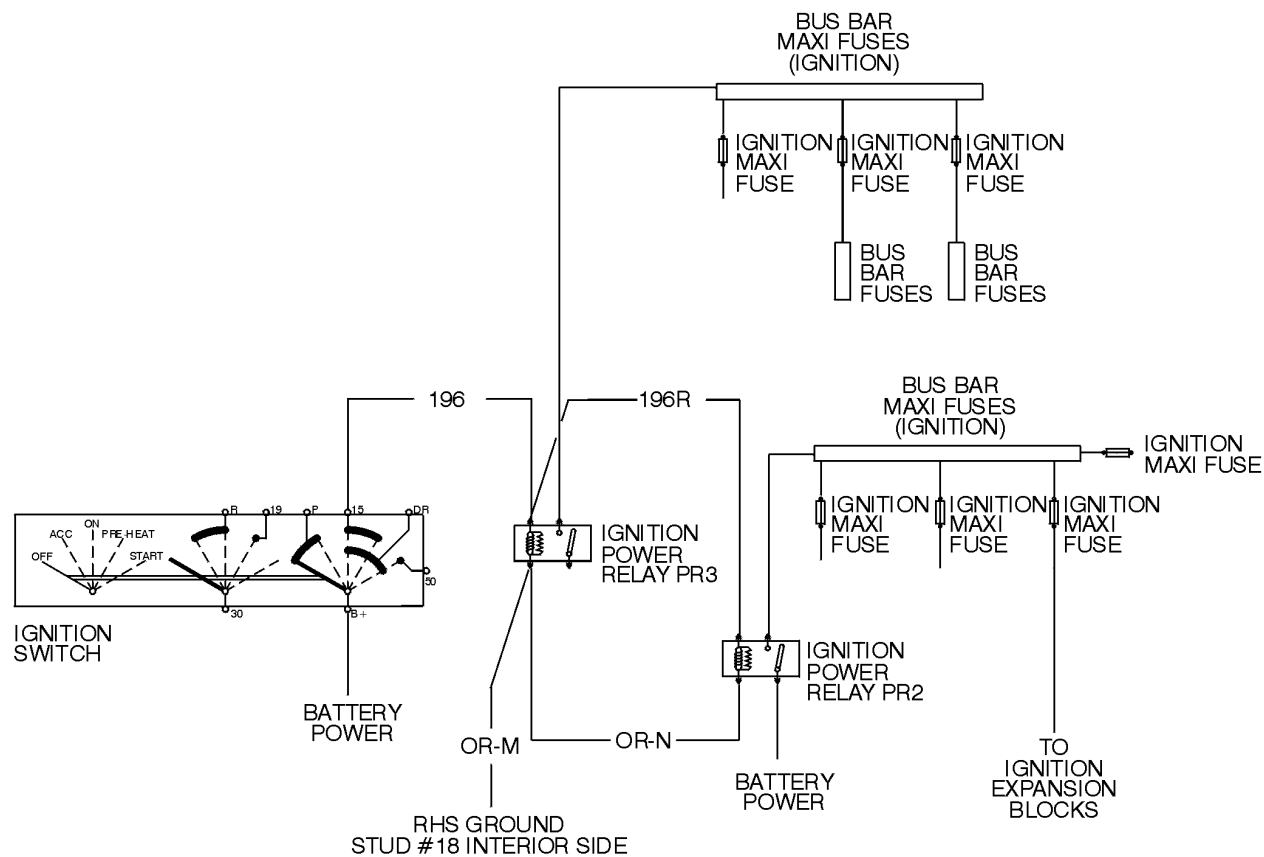
The ignition and battery expansion blocks were designed for plug-in harnesses or fuses only. **DO NOT** plug ATO-size fuses or circuit breakers into either expansion block. These devices will short the power point to the ground bus.

CAUTION

Failure to properly install additional electrical components may adversely affect the operation of the vehicle, including the engine, electrical charging system, truck body, stereo system and the driver information systems.

- Constant battery power is supplied to the ignition switch and Ignition Power Relays. See "Battery Power Supply" page 21.
- When the ignition switch is turned to the ON position, the 196 wires energize the Ignition Power Relay Coils. The relay coils are grounded at ground stud 17 or 18.
- When energized, Ignition Power Relay PR2 supplies power to a maxi-fuse bus bar. These maxi-fuses in turn supply power to expansion block fuses. The ignition power expansion block is used to supply power to optional electrical accessories.
- When energized, Ignition Power Relay PR3 supplies power to a maxi-fuse bus bar. These maxi-fuses in turn supply power to ignition bus bar fuses.
- When energized, Ignition Power Relay PR4 supplies power through a maxi-fuse to an expansion fuse block. The wiring from these fuses supply a chassis harness connector for bodybuilder applications. PR4 is used only on VHD vehicles.
- When energized, Ignition Power Relay R24 supplies power to a start/ignition splice pack for various vehicle functions. R24 is used only on VHD vehicles.

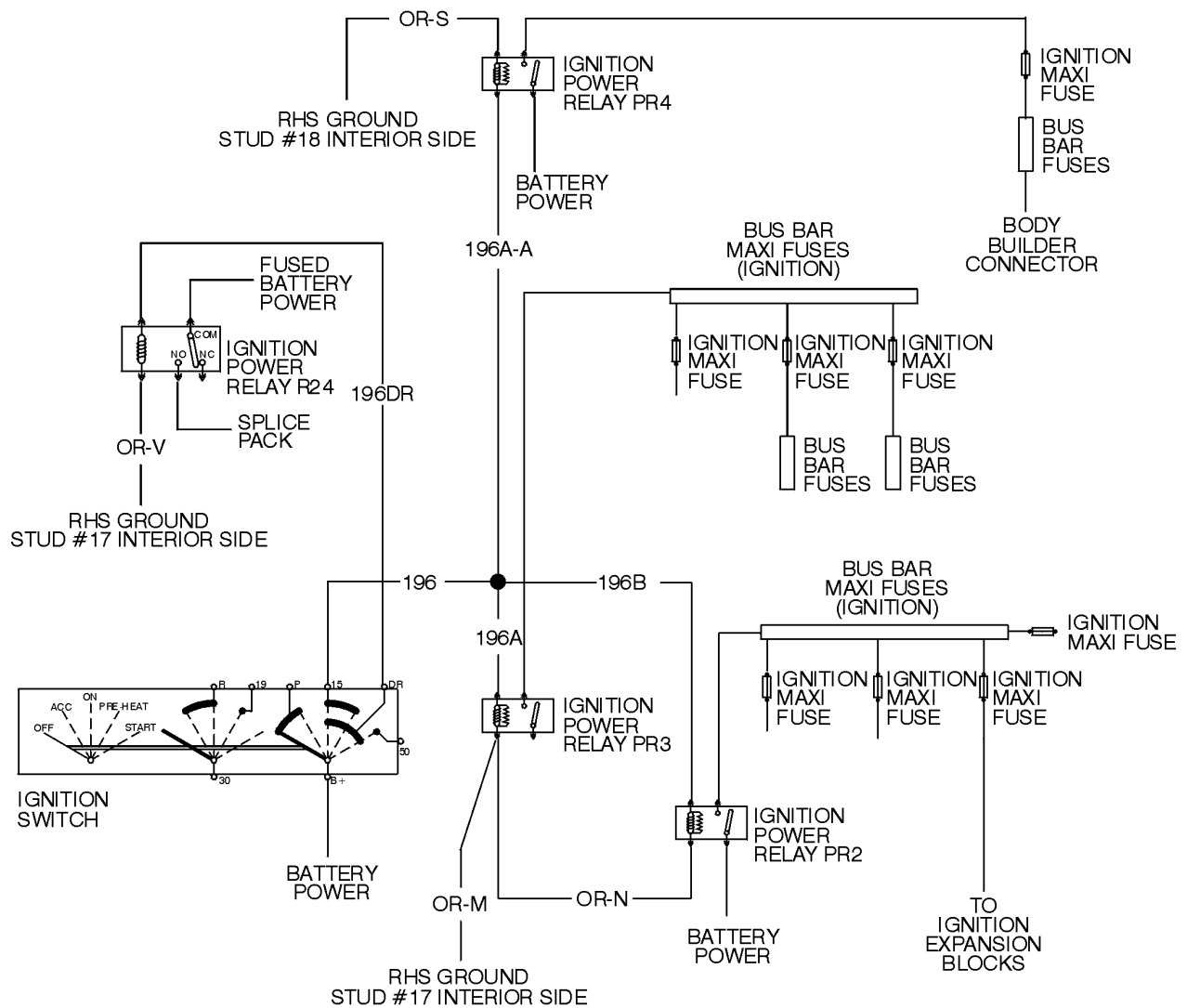
Ignition Power Supply Schematic, VN



W3004360

Fig. 23: Ignition Power Supply: This simplified schematic should only be used to clarify the design features of the VN ignition power supply circuit. For detailed, vehicle-specific schematics, see the "VN Electrical Schematics, Group 37."

Ignition Power Supply Schematic, VHD



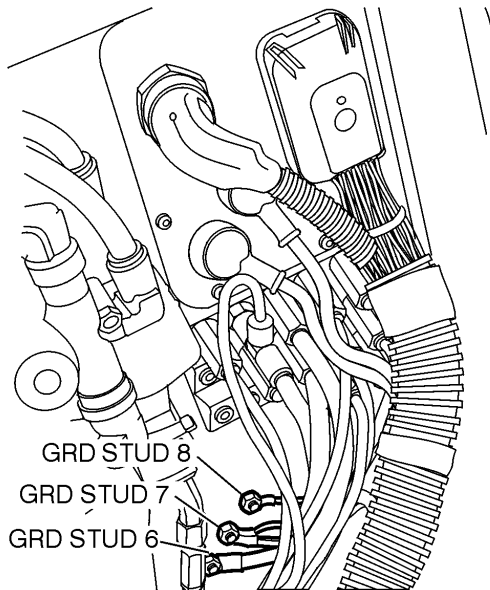
W3004400

Fig. 24: Ignition Power Supply: This simplified schematic should only be used to clarify the design features of the VHD ignition power supply circuit. For detailed, vehicle-specific schematics, see the "VHD Electrical Schematics, Group 37."

System Ground

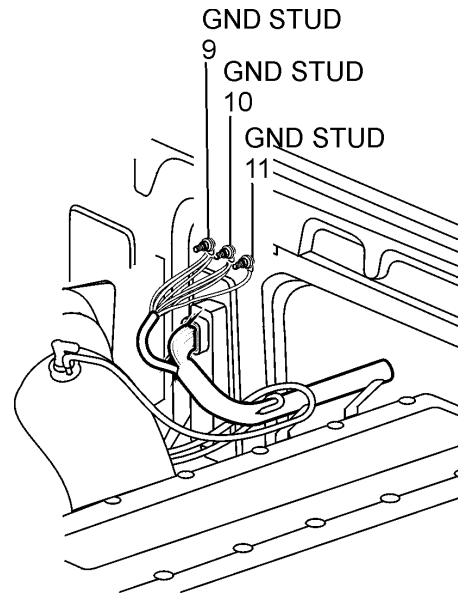
Cab ground studs are located on the left and right side bulkhead, on both the inside and outside. Each stud has a unique identity number which is used for reference in the vehicle electrical schematics. Torque for the ground studs is $10 \pm 1.5 \text{ Nm}$ ($7.4 \pm 1.1 \text{ ft-lb}$).

The cab main ground stud is located on the driver's side, at ground stud 6. The cab main ground stud is wired directly to the engine ground by a 4-gauge cable, and is the ground path for all cab grounds.



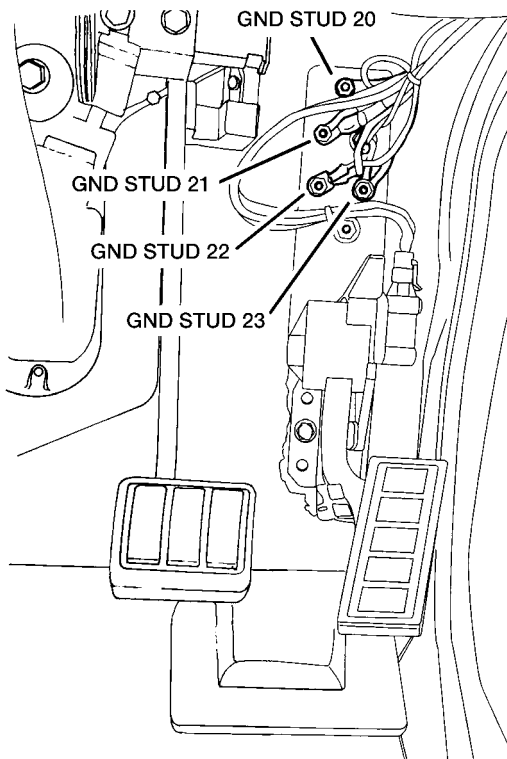
W3004401

Fig. 25: Ground Studs, driver side engine compartment



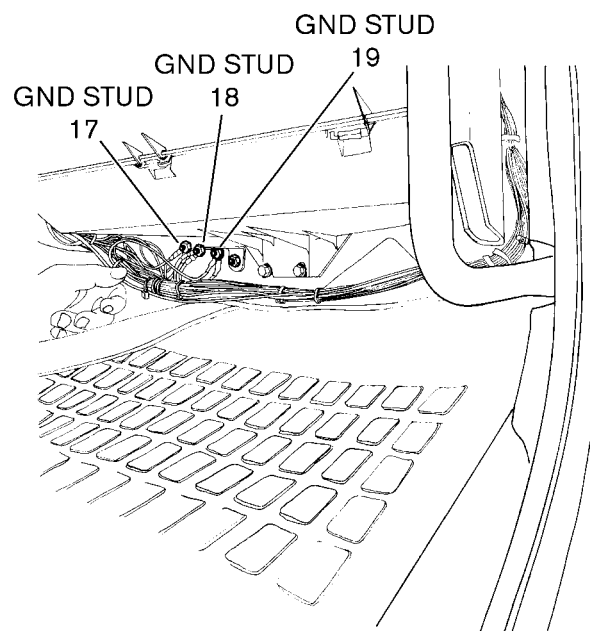
W3004364

Fig. 27: Ground Studs, passenger side engine compartment



W3000593

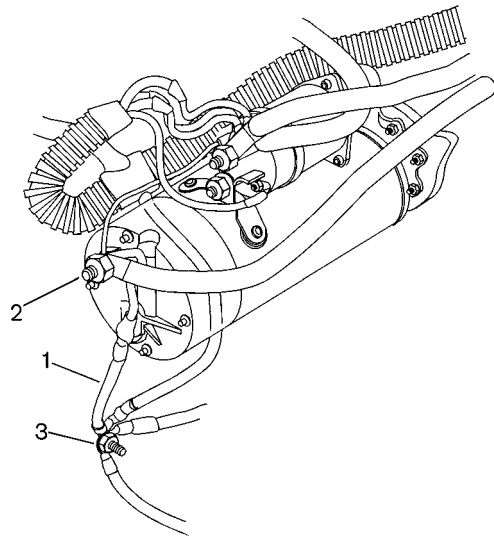
Fig. 26: Ground Studs, inside cab, driver side



W3002759

Fig. 28: Ground Studs, inside cab, passenger side, under heater unit

- The engine ground is the common ground location on the vehicle. The main cab ground, frame rail ground and alternator ground all meet at the engine ground stud. From this common termination point, a fusible link then carries all vehicle return current to the negative battery cable at the ground stud on the starter motor.
- The fusible link is designed to protect the vehicle in the event of a short circuit in a high current component such as an alternator or positive battery cable. Note that the fusible link cannot protect the starter since the starter has a direct cable connection to the batteries.

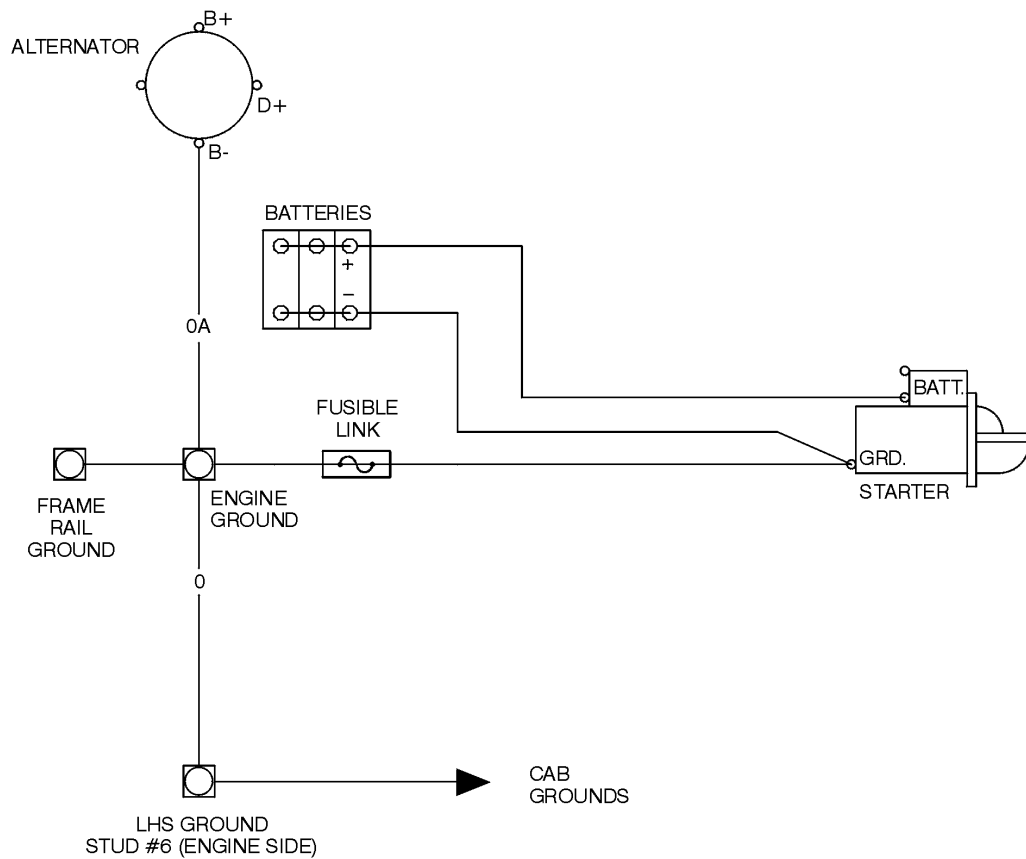


W3002567

Fig. 29: Starter Motor

- 1 Ground Side Fusible Link
- 2 Starter Ground Stud
- 3 Engine Ground (location varies by engine)

System Ground Schematic



W3004345

Fig. 30: System Ground Schematic: This simplified schematic should only be used to clarify the design features of the VN/VHD ground circuit. For detailed, vehicle-specific schematics, see the “VN or VHD Electrical Schematics, Group 37.”

Electrical Pass-through for Cab Wiring

The two main cab cable pass-throughs are on the left and right sides of the bulkhead. The pass-throughs contain connectors which join the inner and outer cable harnesses. The passenger side pass-through contains wiring for chassis mounted components. The driver's side pass-through contains wiring for components mounted under the hood.

Both pass-throughs consist of a protective outer housing and an attachment plate which holds the connectors in position. The pass-through covers can be opened from the outside.

The cab main power studs are located at the left-hand side pass-through. Torque for the main power studs is 10 ± 2 Nm (7.4 ± 1.5 ft-lb).

The Bodybuilder pass-through may be installed in VHD models. It is present only if the Bodybuilder prep kit has been installed. It is located in the center of the cab floor, between the seats, in the center console mounting plate.

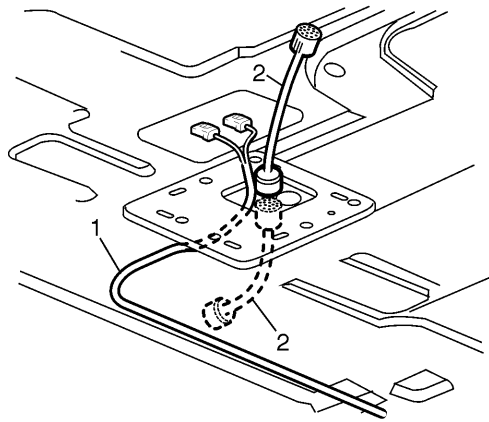


Fig. 31: Bodybuilder Pass-through in Center of Cab Floor

- 1 Bodybuilder Harness from A-pillar
- 2 Bodybuilder Pass-through Wiring

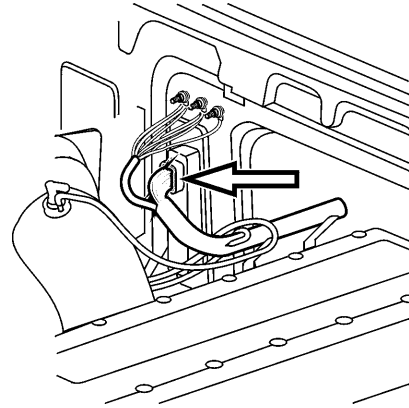


Fig. 32: Cab Electrical Pass-Through (passenger side engine compartment)

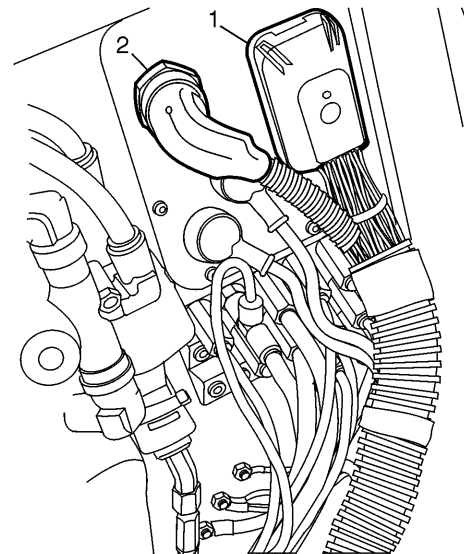


Fig. 33: Main Cab Electrical Pass-Through (driver side engine compartment)

- 1 Pass-through for main cab wiring
- 2 Pass-through for Allison transmission wiring (if equipped, VHD model only)

Fuse and Relay Locations

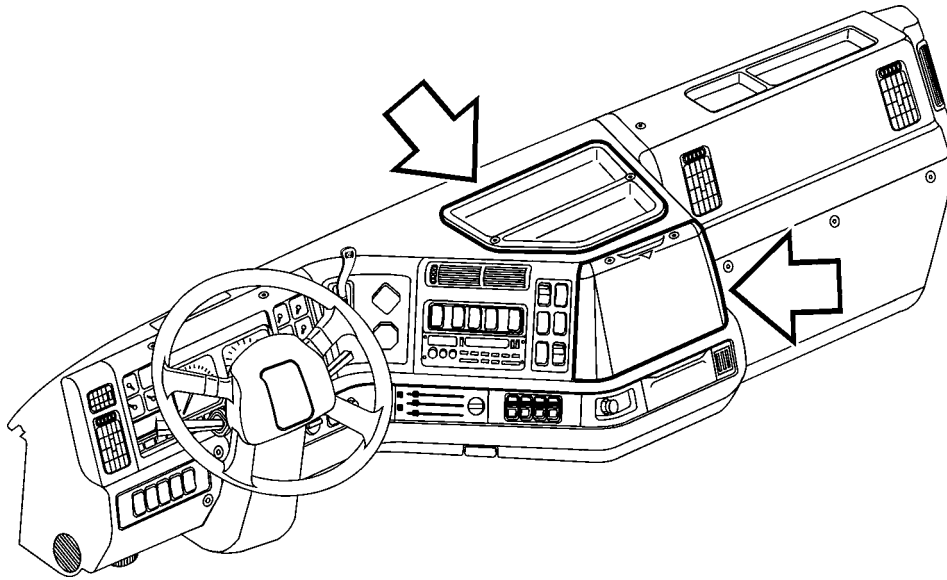


Fig. 34: TEC in Center Dash

W3002492

The vehicle's instrumentation, gauges and other electrically controlled parts are wired through the Truck Electrical Center (TEC). The TEC is located in the center of the dash, just above the engine cover.

VN models built after February 1998 have an updated electrical center. Before 1988 some fuses and relays were located in the front TEC panel. In vehicles built after that date, all fuses and relays are located in the top TEC panel. The VHD TEC center is very similar to VN, but with some additional fuse and relay positions. Vehicles built after February 1998 include accessory and ignition power relays. Also, the daytime running lights module and its relay are located on the single TEC panel. All relays and the DRL module are designed for easy access and replacement.

Refer to the decal inside the TEC cover for vehicle's exact fuse locations and ratings. (Note that all fuses and relays may not be used in every vehicle.)

The TEC panel includes all maxi-fuses, mini-fuses, relays and micro-relays. Maxi-fuses are designed for larger amounts of current than regular fuses. The micro ISO relays are smaller in size than conventional relays, and the pin arrangement is different. Mini-fuses are also smaller in size, but the current rating is the same as ATO-size fuses.

Additional TEC Components

Volvo Engines Only

Located in front of the fuse and relay panel is the Vehicle Electronic Control Unit, or VECU (standard with Volvo engines). The VECU is accessible by removing the front TEC panel. It gathers cab switch and sensor information and communicates with the engine ECU. Many vehicle functions controlled by the combi relay on previous versions of Volvo engines are now controlled by the VECU. For example, the intermittent wiper function on these vehicles is now controlled by the VECU. For more information on the windshield wiper function, see "Vehicle ECU" page 55 in this manual.

The central door lock module is mounted to the left of the VECU. The central door lock module is covered later in this manual. See "Central Door Lock Module" page 56.

Fuse and Relay Positions, VN

Note: Refer to the decal inside the TEC cover for vehicle's exact fuse descriptions and ratings.

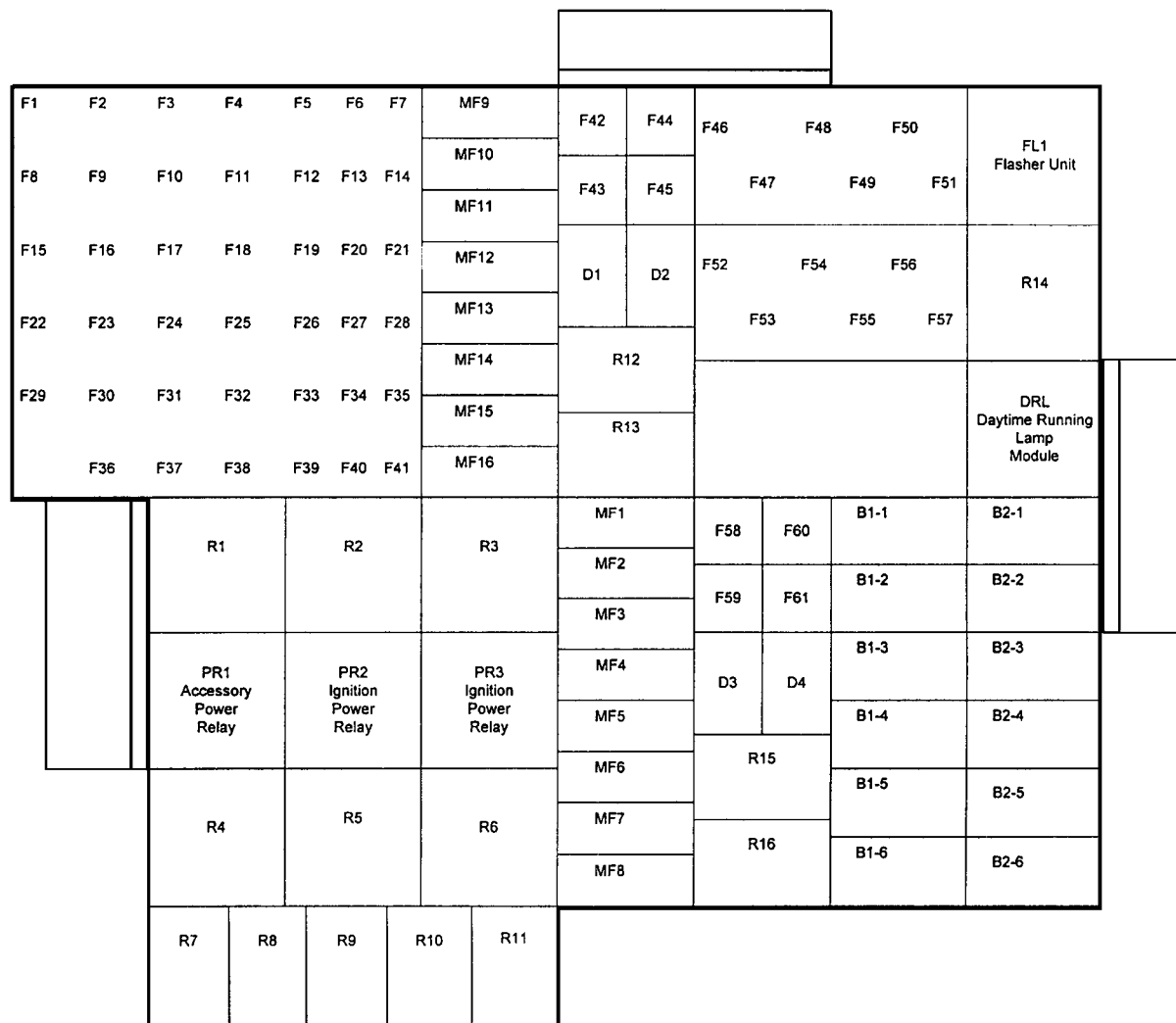


Fig. 35: Fuse and Relay Positions (in the top TEC panel), VN

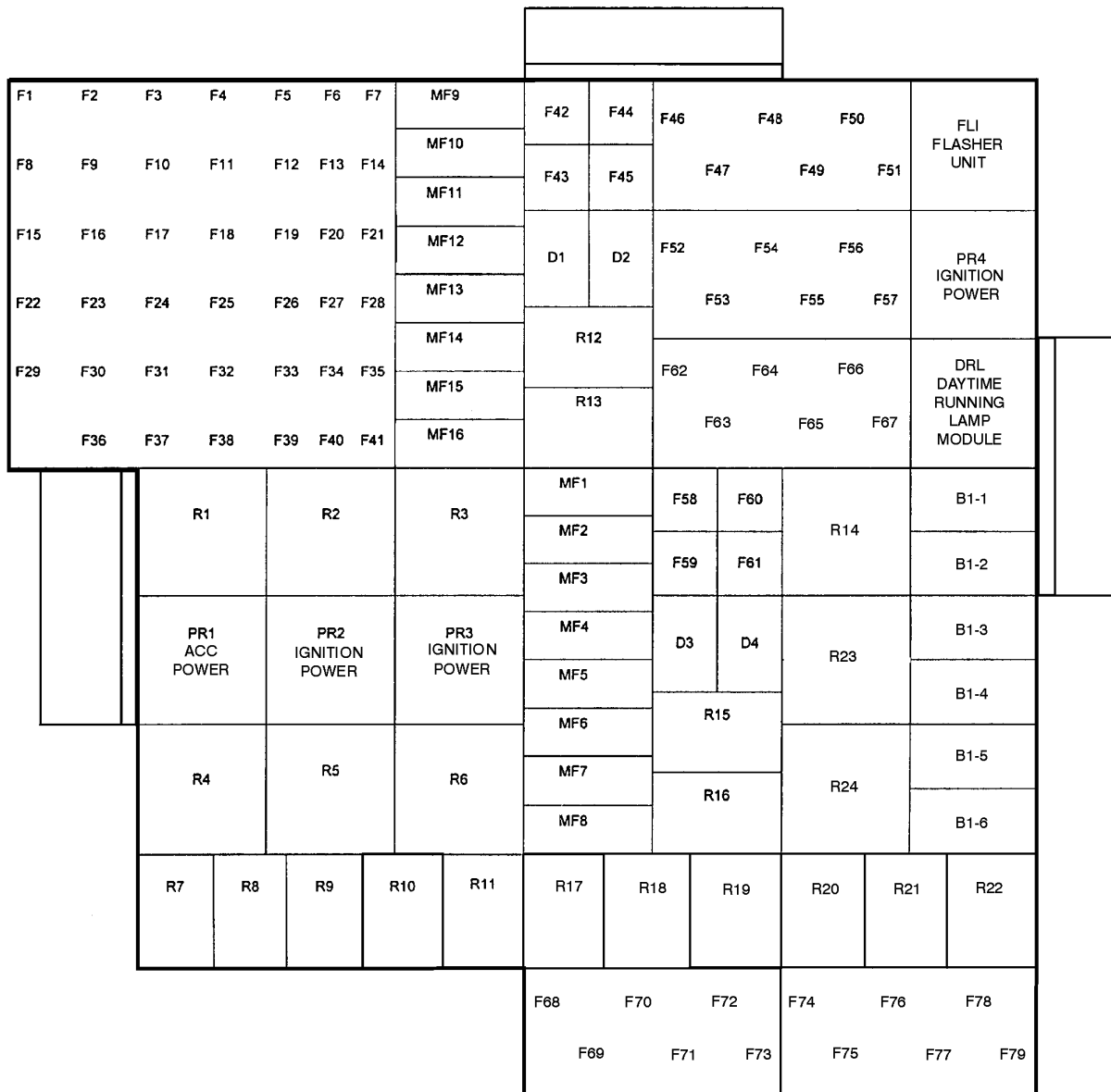
W3002729

B1-1 through B1-6	Ignition Expansion Blocks
B2-2 through B2-4	Battery Expansion Blocks
PR1	Accessory Power Relay
PR2, PR3	Ignition Power Relays

One Accessory and two Ignition Power relays are used to transfer the heavy current load coming from the battery to the Ignition/Accessory circuits. These relays are located on the TEC tray for easy access and replacement.

Fuse and Relay Positions, VHD

Note: Refer to the decal inside the TEC cover for vehicle's exact fuse descriptions and ratings.



W3004362

Fig. 36: Fuse and Relay Positions (in the top TEC panel), VHD

- B1-1 through B1-6** Battery and Ignition Expansion Blocks
- PR1** Accessory Power Relay
- PR2, PR3, PR4, R24** Ignition Power Relays

One Accessory and four Ignition Power relays are used to transfer the heavy current load coming from the battery to the Ignition/Accessory circuits. These relays are located on the TEC tray for easy access and replacement. PR4 is used in VHD bodybuilder applications.

Switches and Controls

Dash Switches

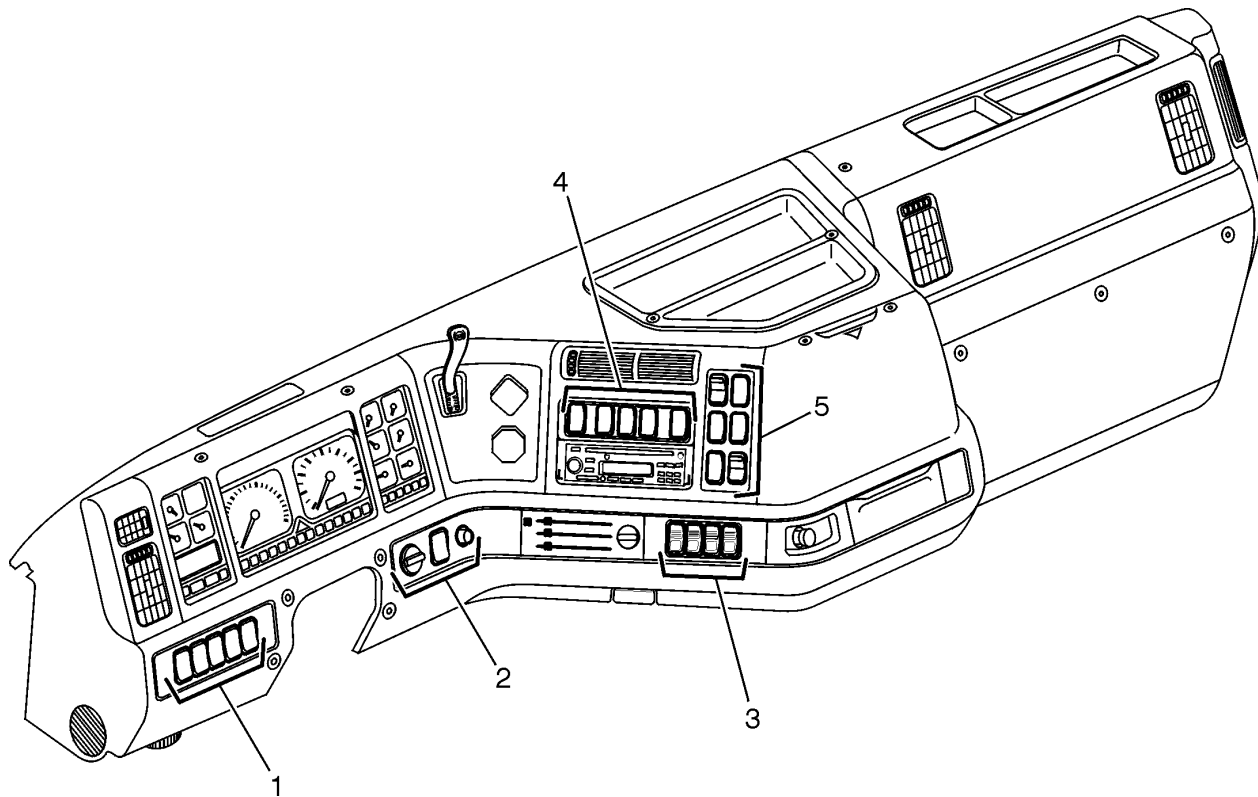


Fig. 37: Dash Switches

W3004361

- 1 Left Dash Switches
- 2 Driving Light Switches
- 3 Pneumatic Switches
- 4 Auxiliary Switches
- 5 Right Dash Switches

All dash-mounted switches feature heavy duty terminals and locking mating connectors. Rocker switches have illuminated legends with embedded LEDs to indicate *ON* or *OFF* status of electrical devices.

Left Dash Switches

The left dash switches may include hazard (4-way flashers), back of cab, headlamp interrupt (flash-to-pass), snowplow light, sleeper overhead light, smoke detector disable, or power take-off.

Driving Light Switches

Driving light switches include headlamp/parking, fog and driving, and dimmer control.

Pneumatic Switches

Pneumatic switches may include interaxle lock, interwheel lock, suspension level/dump and sliding fifth wheel.

Auxiliary Switches

These switches are used for additional customer requested components. Some vehicles may have other dash-mounted equipment, such as Road Relay or Autoshift, mounted in the optional switch location tray. VHD vehicles may have beacon lights and lift axle switches in this location.

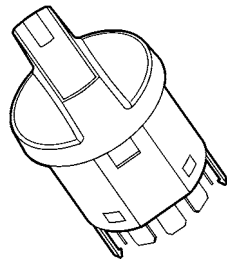
Right Dash Switches

The right dash switches may include marker light interrupt, traction control, heated mirror, idle/diagnostic and engine/exhaust brake. Optional switches are used for additional customer requested components.

Switch Logic Diagrams

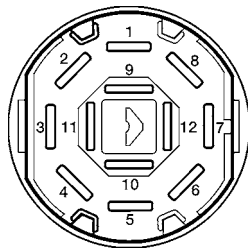
Note: Switches are illustrated from wire insertion-side view.

Headlamp/Parking Lamp Switch



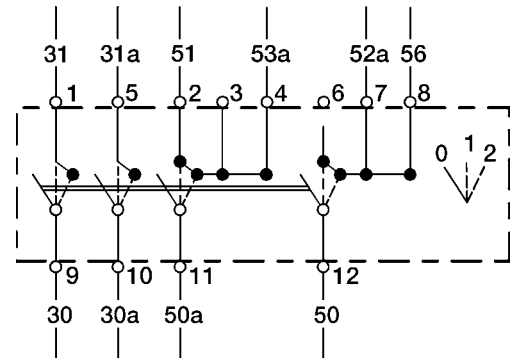
W3000575

Fig. 38: Switch



W3000576

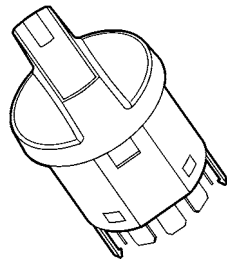
Fig. 39: Switch, Wire Insertion Side View



W3000582

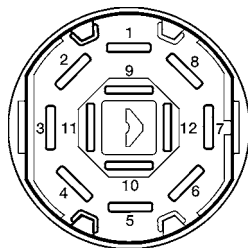
Fig. 40: Internal Switch Logic

Heater/AC Blower Motor Control



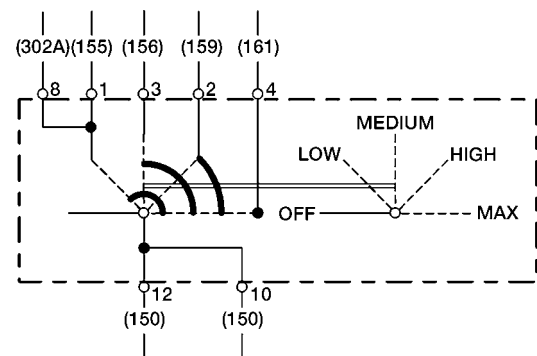
W3000575

Fig. 41: Switch



W3000576

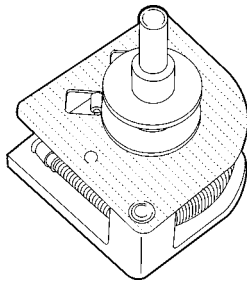
Fig. 42: Switch, Wire Insertion Side View



W3000688

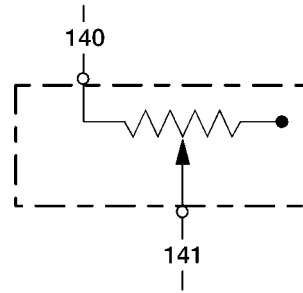
Fig. 43: Internal Switch Logic

Dimmer Control (Dash Illumination)



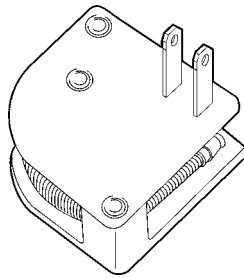
W3000685

Fig. 44: Switch



W3000676

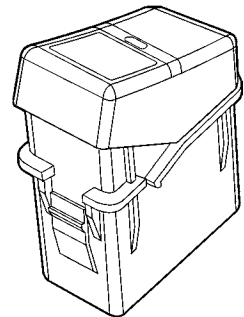
Fig. 46: Internal Switch Logic



W3000686

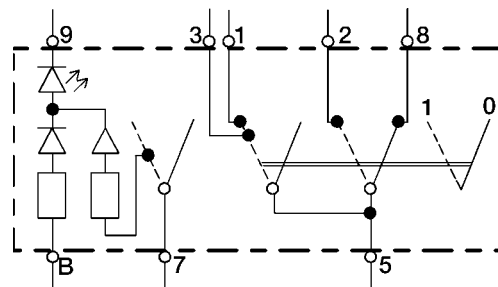
Fig. 45: Switch, Wire Insertion Side View

Hazard Warning



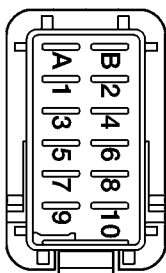
W3000579

Fig. 47: Switch



W3000585

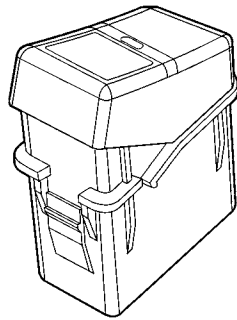
Fig. 49: Internal Switch Logic



W3000577

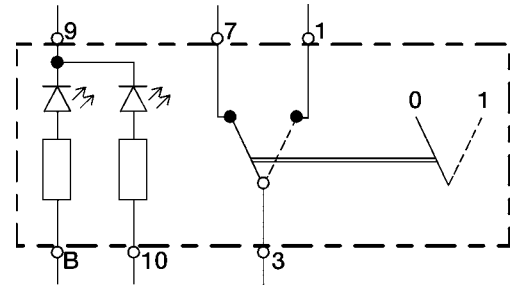
Fig. 48: Switch, Wire Insertion Side View

Back of Cab Lamp, Heated Mirror, Auxiliary Lamps, Traction Control System, Beacon/Snow Plow Lights, Smoke Detector Disable, Bunk Overhead Light (VN770)



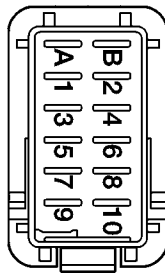
W3000579

Fig. 50: Switch



W3000588

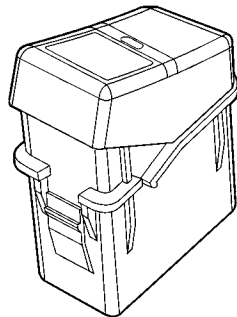
Fig. 52: Internal Switch Logic



W3000577

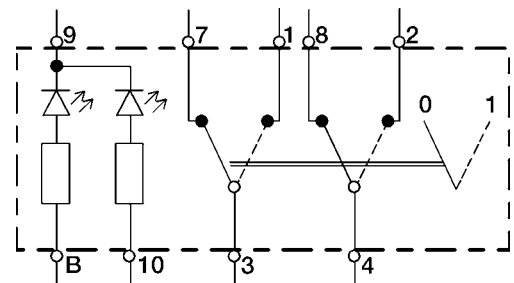
Fig. 51: Switch, Wire Insertion Side View

Power Take Off, VN



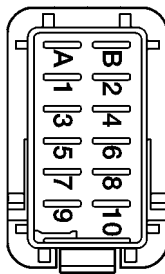
W3000579

Fig. 53: Switch



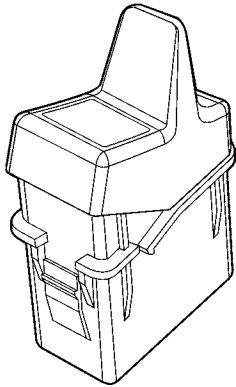
W3000587

Fig. 55: Internal Switch Logic



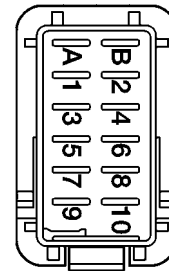
W3000577

Fig. 54: Switch, Wire Insertion Side View

Marker Interrupter, Headlight Interrupter Switch

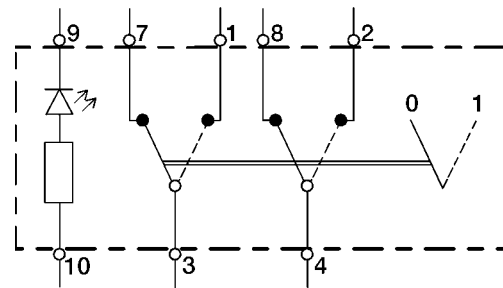
W3000578

Fig. 56: Switch



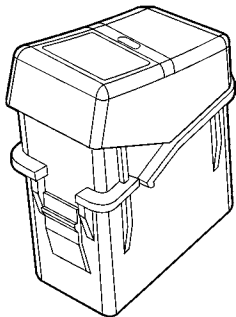
W3000577

Fig. 57: Switch, Wire Insertion Side View



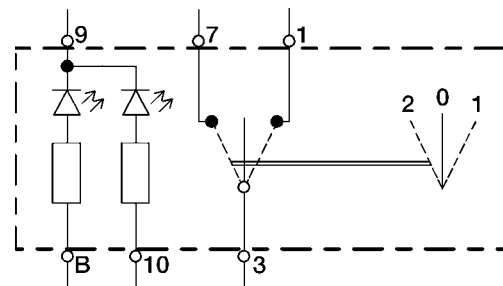
W3000586

Fig. 58: Internal Switch Logic

Idle Diagnostic (Cummins Only)

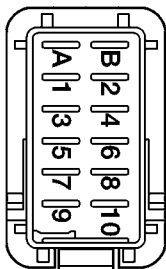
W3000579

Fig. 59: Switch



W3000584

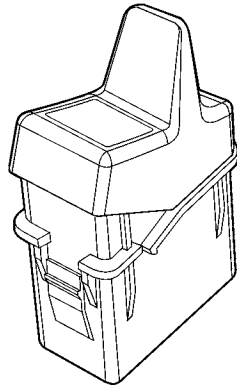
Fig. 61: Internal Switch Logic



W3000577

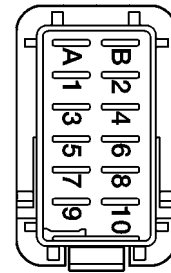
Fig. 60: Switch, Wire Insertion Side View

Engine Brake On/Off



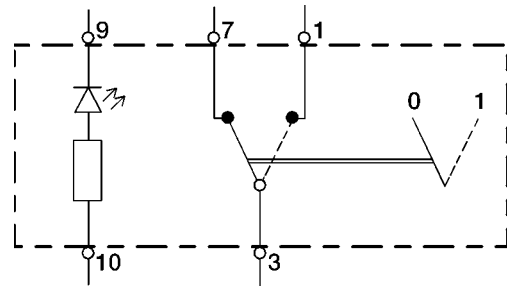
W3000578

Fig. 62: Switch



W3000577

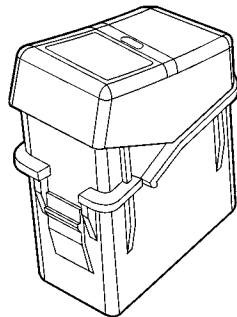
Fig. 63: Switch, Wire Insertion Side View



W3000589

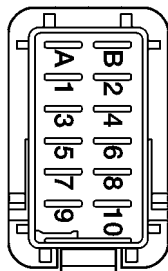
Fig. 64: Internal Switch Logic

Engine Brake Low/Med/High



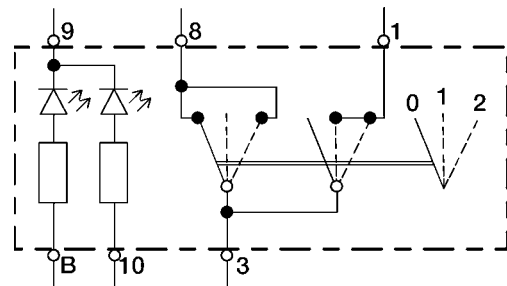
W3000579

Fig. 65: Switch



W3000577

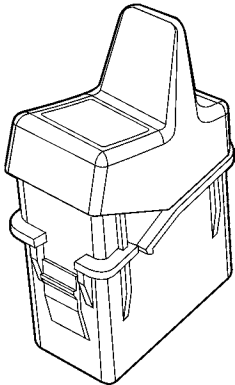
Fig. 66: Switch, Wire Insertion Side View



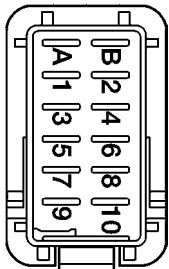
W3000583

Fig. 67: Internal Switch Logic

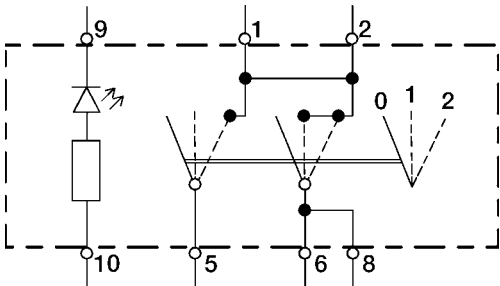
Engine Brake Off/Low/High



W3000578
Fig. 68: Switch

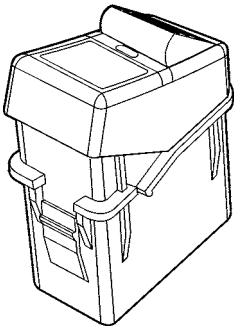


W3000577
Fig. 69: Switch, Wire Insertion Side View

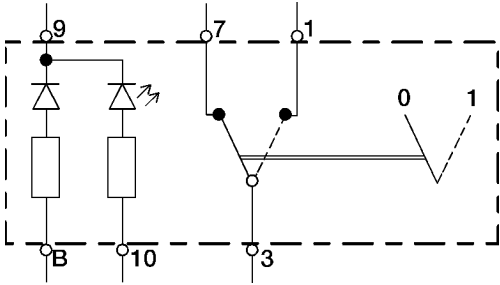


W3000597
Fig. 70: Internal Switch Logic

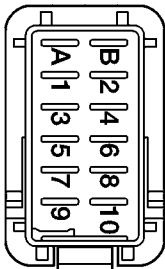
Power Take Off (VHD), Lift Axle Switches



W3004415
Fig. 71: Switch

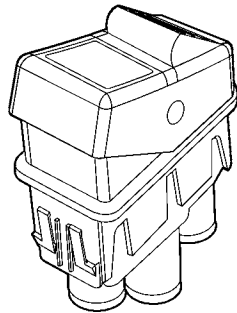


W3004363
Fig. 73: Internal Switch Logic



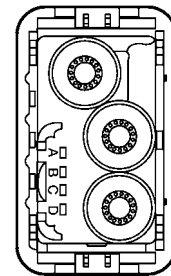
W3000577
Fig. 72: Switch, Wire Insertion Side View

Pneumatic Switches



W3000574

Fig. 74: Switch

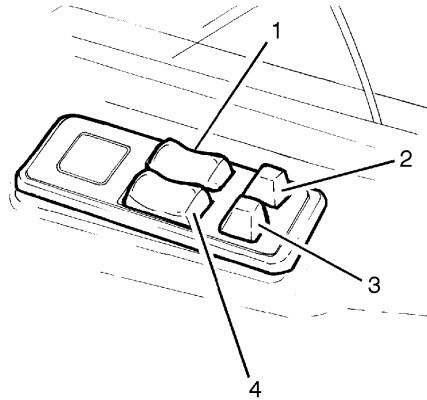


W3000573

Fig. 75: Switch, Wire Insertion Side View

Switch Function	Terminal			
	A	B	C	D
Interaxle DLO	To Cluster Telltale Lamp	+12V Supply	Ground	+12V Illumination Control
Fifth Wheel Slide	To Cluster Telltale Lamp	Not used	Ground	+12V Illumination Control
Suspension Dump	To Cluster Telltale Lamp	Not used	Ground	+12V Illumination Control
Interwheel DLO	N/A	Not used	Ground	+12V Illumination Control

Door Switches



W3004338

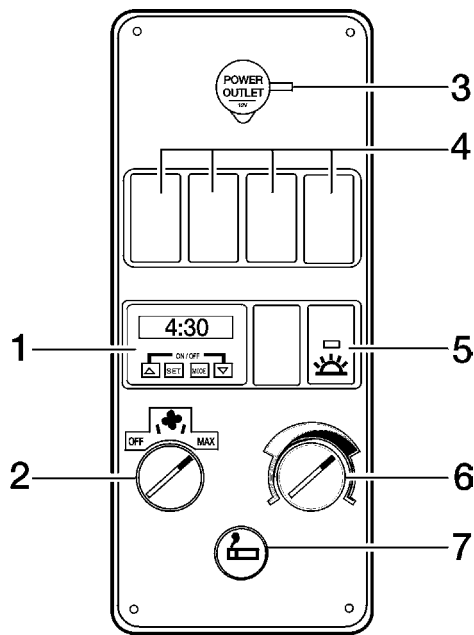
Fig. 76: Switches on Driver's Door

- 1 Driver Side Window Switch
- 2 Driver Side Mirror Switch
- 3 Passenger Side Mirror Switch
- 4 Passenger Side Window Switch

The driver's door may include switches to control the horizontal and vertical positioning of both the left and right "west coast" mirrors. The driver's door may also include window switches to control both the left and right windows. The passenger side may only include a window switch to control the right window.

Sleeper Control Panel Switches

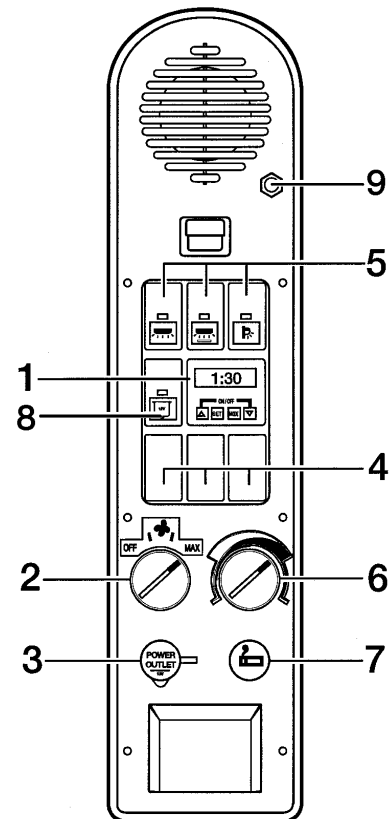
There are two sleeper control panels. One for the VN420, 610 and 660. The other is for the VN770 only. Both have controls for the bunk climate control system, power outlets, a digital alarm clock and light control switches. The VN770 panel has an additional switch to control the 12-volt power supply to the left side tower cabinet power outlets, and an optional remote TV speaker and headphone jack.



W8002382

Fig. 77: Bunk Control Panel, VN421, 610, 660

- 1 Alarm Clock/Timer
- 2 Fan Speed Control
- 3 12V Power Outlet
- 4 Optional Switches
- 5 Interior Cab Light Switches
- 6 Temperature Control
- 7 Cigarette Lighter



W3004366

Fig. 78: Bunk Control Panel, VN770

- 1 Alarm Clock/Timer
- 2 Fan Speed Control
- 3 12V Power Outlet
- 4 Optional Switches
- 5 Interior Cab Light Switches
- 6 Temperature Control
- 7 Cigarette Lighter
- 8 12V Power Switch to Left Tower Cabinet
- 9 Headphone Jack

Ignition Switch

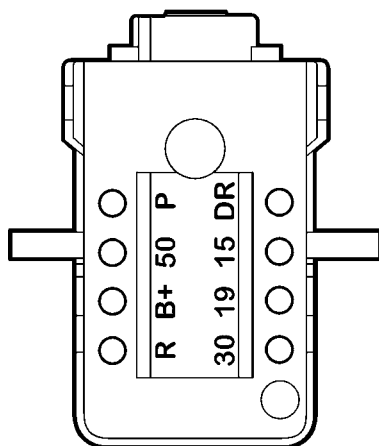


Fig. 79: Ignition Switch Connector Detail

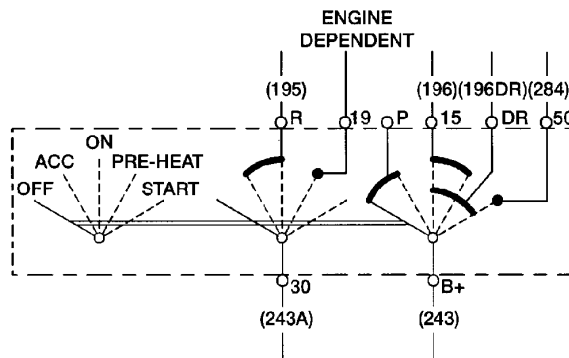


Fig. 80: Ignition Switch Logic Diagram

W3004344

Note: Numbers inside parenthesis are circuit numbers.

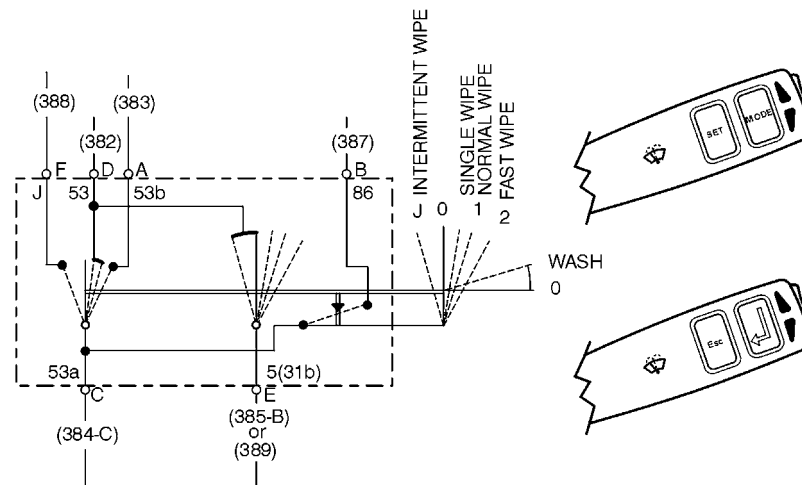
The ignition switch is mounted in the key lock assembly. It is a single switch of a double contact design – there is no separate start button. The chart below gives the pin and circuit description.

Note: The ignition switch and door locks use the same laser cut key. Laser cut keys require special key cutting equipment that most locksmiths will not have. Replacement keys can be ordered from Volvo by key code.

Pin	Circuit No.	Description
R	195	To accessory power relay coil
B+	243	+12V Battery supply
50	284	Starter relay feed
P		Not used
30	243A	+12V Battery supply
19	Engine dependent: VOLVO: 245 Detroit Diesel: 591	VOLVO: Preheat request Detroit Diesel: Shutdown override relay feed
15	196	To ignition power relay coil
DR	196DR	Ignition feed

Stalk Switches

Wiper/Washer Switch



W3004343

Fig. 81: Wiper/Washer Switch

Note: Numbers inside parenthesis are circuit numbers.

Controls for the windshield wiper/washer are on the stalk on the right-hand side of the steering column.

Intermittent wipers are pre-set to make a single sweep every 10 seconds. The interval can be set to between 1 and 10 seconds by moving the wiper stalk to the intermittent position, then to off, then to intermittent again when another sweep is desired.

The intermittent wiper function is controlled differently, depending on the engine variant. On vehicles with Volvo engines, the Vehicle Electronic Control Unit (VECU) and intermittent wiper relay are used. On vehicles with other engines, a wiper control module is used.

For more complete information on the wiper/washer system, including troubleshooting and service procedures, see:

Paper "Windshield Wiper System, VN/VHD", publication number PV776–TSP143133.

Impact Function Group 36.

Wiper/washer Switch Connector		
Pin	Circuit No.	Description
A	383	High Speed Wiper
B	387	12V Supply to Washer Motor
C	384-C	12V Supply to Wiper Motor
D	382	Low Speed Wiper
E	389	12V Supply to Wiper Control Module
	385B	12V Supply to VECU
F	388	12V Supply to Wiper Control Module, VECU

Graphic Display Switch

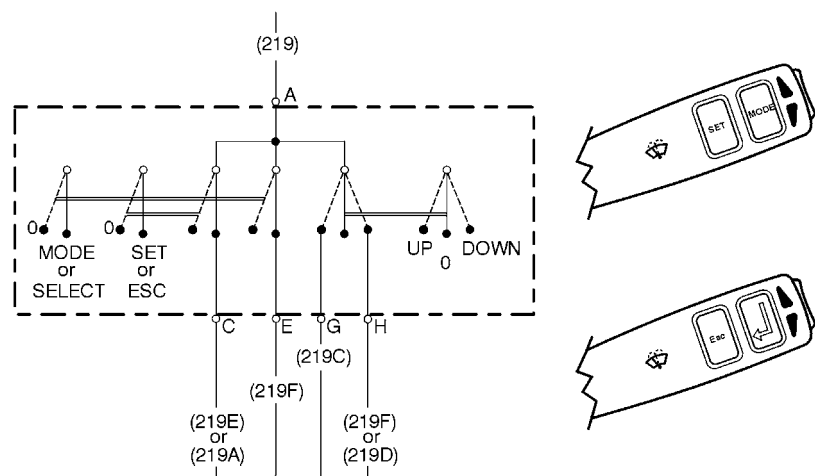



Fig. 82: Graphic Display Mode/Set or Esc/Select Switch

Note: Numbers inside parenthesis are circuit numbers

Controls for the instrument cluster’s graphic display window are located on the stalk switch to the right of the steering column. The Esc and Select (or mode and set) buttons allow for different vehicle information to be displayed. The up and down buttons at the end of the stalk are used to scroll through the various display menus.

The mode and set buttons were used until March 1999. Since then, the Esc and select () buttons have been used.

For more complete information on the graphic display switch, including troubleshooting and service procedures, see:

Paper “Windshield Wiper System, VN/VHD”, publication number PV776–TSP143133.

Impact Function Group 36.

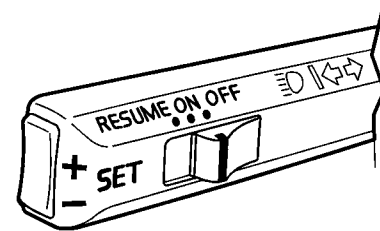
Graphic Display Switch Connector		
Pin	Circuit No.	Description
A	219	Common 12V Supply
C	219E	"SET" Input
	219A	"ESCAPE" Input
E	219F	"MODE" Input
	219D	"SELECT" Input
G	219C	"UP" Input
H	219B	"DOWN" Input

Cruise Control, Turn Signal and Headlamp Dimmer Switch (Volvo Engines Only)

The controls for turn signals, cruise control and highbeam/lowbeam selection are on the stalk switch on the left-hand side of the steering column. The highbeam/lowbeam switch works by pulling back on the stalk. This switch includes a “flash to pass” feature.

It is possible to increase or decrease the engine speed by pressing the button at the end of the stalk. Pressing the top of the button, toward the + sign, will increase vehicle speed while pressing the lower part of the button, the – sign, will decrease speed. To return to the set speed, move the switch on the stalk toward “Resume”.

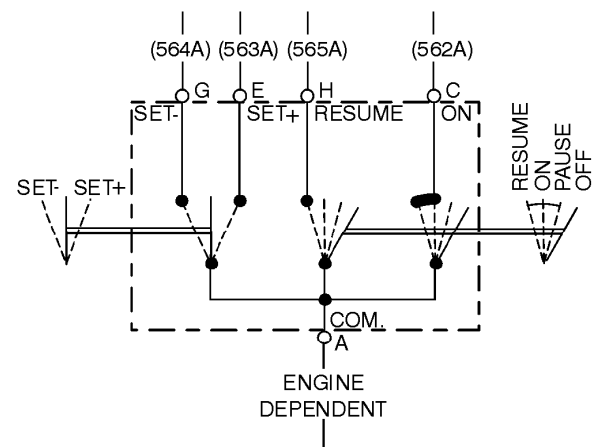
The Cruise control switch may also be used to control engine speed on vehicles equipped with PTOs.



W3002499

Fig. 83: Cruise Control Switch (Volvo Engines Only)

Cruise Control Connector		
Pin	Circuit No.	Description
A	Engine Dependent	Common
C	562A	Cruise control On
E	563A	Cruise control Set +
G	564A	Cruise control Set –
H	565A	Cruise control Resume



W3004386

Fig. 84: Cruise Control Switch Logic Diagram (Volvo Engines Only)

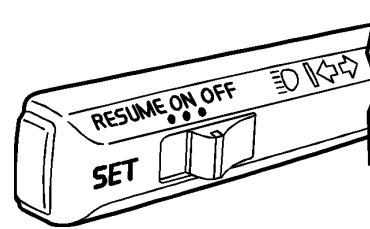
Note: Numbers inside parenthesis are circuit numbers.

Cruise Control, Turn Signal and Headlamp Dimmer Switch (Other Engines)

For these engines, the controls for turn signals, cruise control and highbeam/lowbeam selection are on the stalk switch on the left-hand side of the steering column. The highbeam/lowbeam switch works by pulling back on the stalk. This switch includes a “false to pass” feature.

It is possible to increase the engine speed with the button at the end of the stalk. To return to the set speed, move the switch on the stalk toward “Resume”.

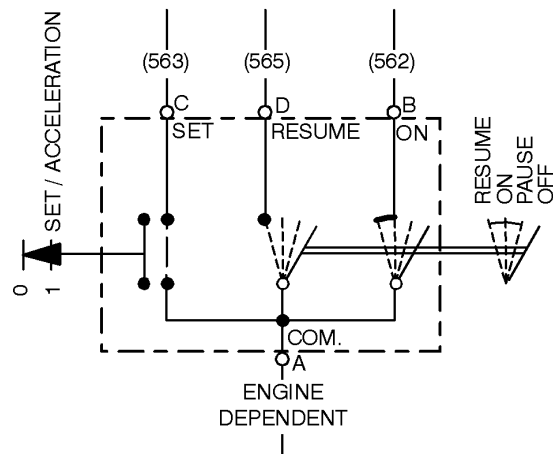
The Cruise control switch may also be used to control engine speed on vehicles equipped with PTOs.



W3000807

Fig. 85: Cruise Control Switch
(Caterpillar, Cummins, Detroit Diesel Engines)

Cruise Control Connector		
Pin	Circuit No.	Description
A	Engine Dependent	Common
B	562	Cruise control On
C	563	Cruise control Set +
D	565	Cruise control Resume



W3004385

Fig. 86: Cruise Control Switch Logic Diagram
(Caterpillar, Cummins, Detroit Diesel Engines)

Note: Numbers inside parenthesis are circuit numbers.

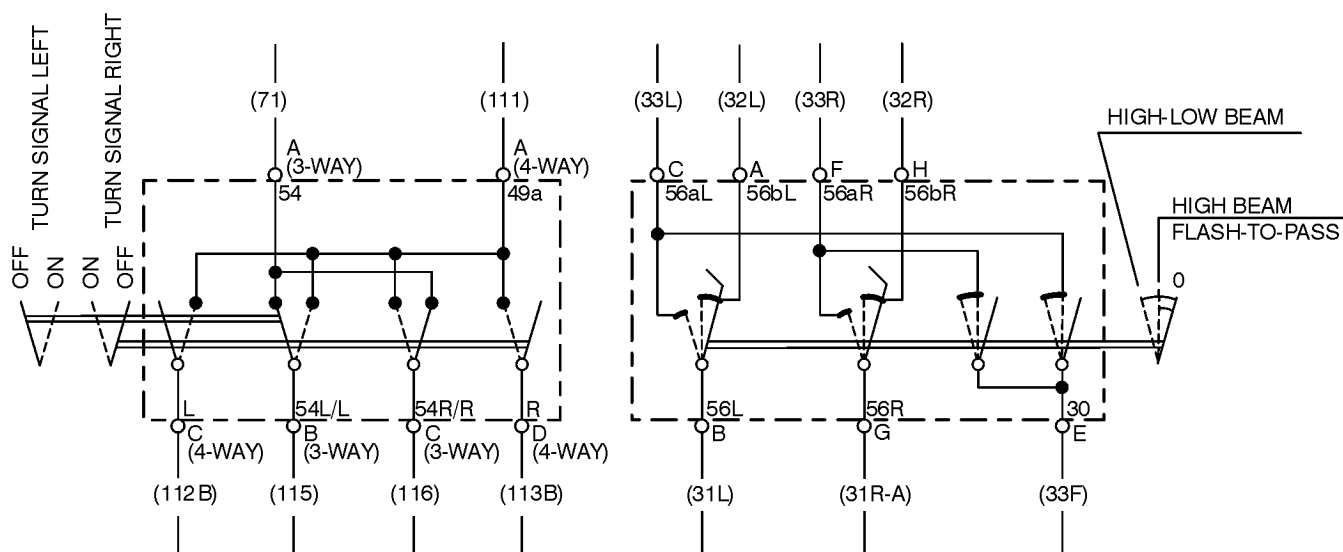


Fig. 87: Turn Signal and High/Low Beam Switch Logic Diagram

W3004427

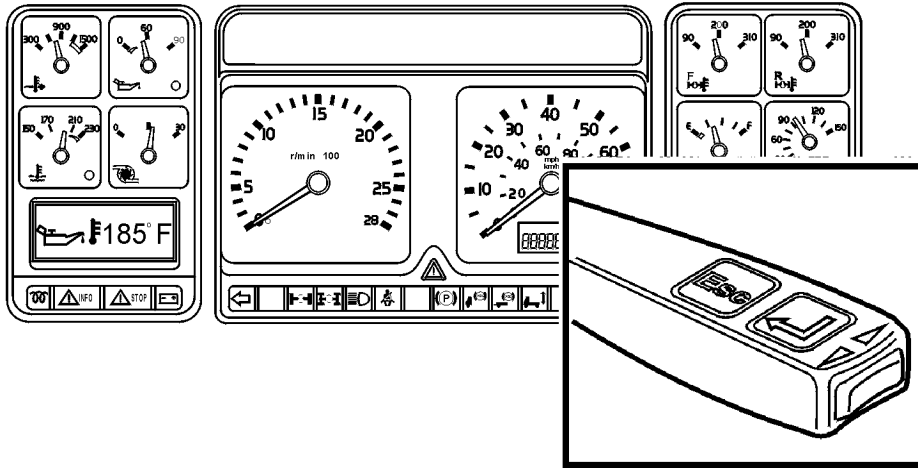
Note: Numbers inside parenthesis are circuit numbers.

Turn Signal Connector (3 way)		
Pin	Circuit No.	Description
A	71	Stop lamp switch output
B	115	Left stop & turn lamp feed
C	116	Right stop & turn lamp feed

Turn Signal Connector (4 way)		
Pin	Circuit No.	Description
A	111	Turn signal switch feed
B		Not used
C	112B	Left turn signal lamp & indicator feed
D	113B	Right turn signal lamp & indicator feed

Headlamp Dimmer Switch Connector		
Pin	Circuit No.	Description
A	32L	Output to DRL module low beam, left
B	31L	Dimmer switch power supply
C	33L	Headlamp high beam ground, left
D		Not used
E	33F	Flash to pass (headlight interrupt) contact
F	33R	Headlamp high beam ground, right
G	31R-A	Dimmer switch power supply
H	32R	Output to DRL module low beam, right

Instrumentation



W3004310

In January 1998, an updated instrument panel was introduced for the VN, with a number of changes from panels included in earlier models. These changes include the graphic display control buttons, now located on the wiper/washer switch. The cluster is available in 7 configurations, with either an mph or km/h speedometer. Particular variants depend on the options chosen for the vehicle.

For instrumentation design, troubleshooting and service procedures, see VN/VHD service information in group 38.

The instruments are divided into three groups:

On a truck with the standard instrument cluster, the left-hand instrument section contains gauges for coolant temperature and oil pressure, as well as the graphic display and indicator lamps. Optional pyrometer and turbo gauges may be installed. The Info and Stop warning lamps are on this side, and are used to warn of engine cautions and engine shutdowns. The other lamps are for low engine fluid and preheater.

The center group is always the same, regardless of which options are installed on the vehicle. The center instrument group contains, in addition to a number of indicator and warning lamps, the tachometer and speedometer/odometer.

The right-hand instrument section contains the fuel and brake pressure gauges, and the remainder of the warning lamps. Axle temperature and air pressure gauges may be installed.

Note that all gauges and telltales may not be used in all vehicles.

Lighting System

The lighting system of the VN/VHD series may incorporate different design lamp assemblies for each vehicle type. The headlights on the VN use replaceable halogen bulbs that fit into a reflector housing. The VHD uses the more traditional sealed beam bulbs.

Daytime running lights turn the low beam headlights on whenever the ignition switch is on and the park brake is released.

Fog and driving lights are available. When switched on, these lights will alternate between fog lights with the headlamp low beams on, and driving lights with the headlamp high beams on.

For more information on the lighting system, including design and function, troubleshooting and service procedures, see the service information on lighting in Group 35.

Supplemental Restraint System

Volvo vehicles may be equipped with a Supplemental Restraint System (SRS). The SRS is supplemental protection for use together with the safety belt. The SRS is designed to reduce the risk of injury to the driver's face and upper body.

The system consists of an inflatable bag mounted in the center of the steering wheel, and a control unit mounted on the bulkhead inside the cab. A chemical based gas generator attached to the rear of the bag inflates the bag in the event of a collision.

Sensors in the control unit detect deceleration. If the control unit detects a sufficiently violent deceleration (collision), the system is activated. The gas generator activates and fills the bag with a harmless gas within a few hundredths of a second. During a collision, after the bag has been filled, the gas flows out through two holes in the back of the bag. These holes are large enough to let the airbag collapse slowly, gently catching the driver.

The control unit also contains a standby power unit which can supply the system with power for a short time should the normal power supply be broken.

For more information on SRS see the VN/VHD service information in Group 88.

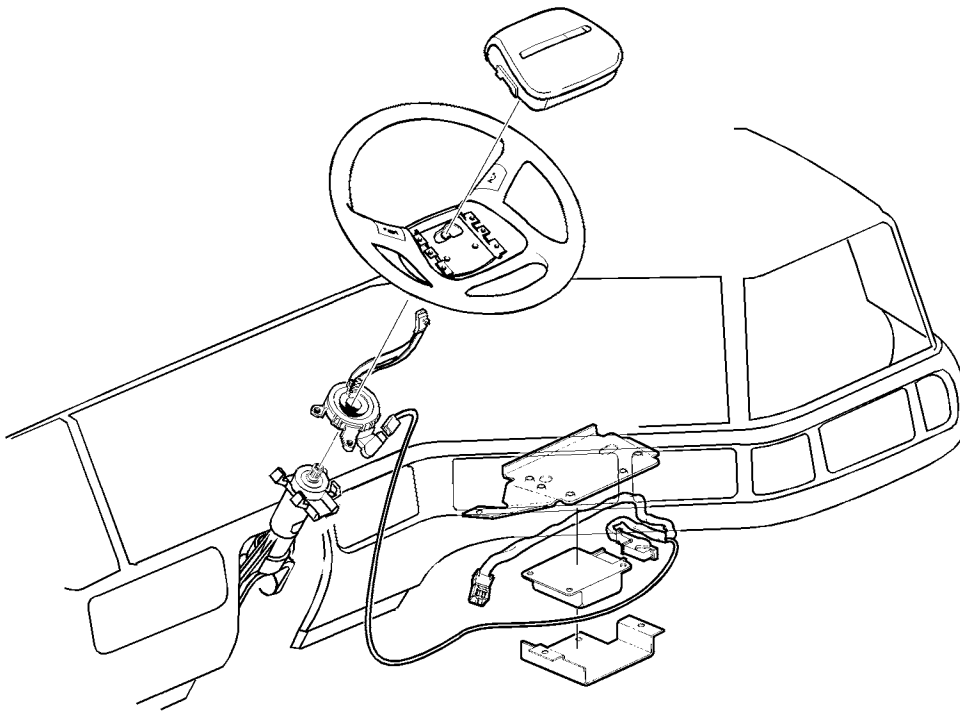
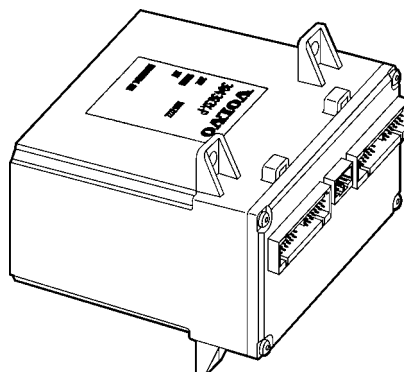


Fig. 88: SRS System

W8001291

Vehicle ECU



W2002673

Fig. 89: VECU

Vehicles with Volvo engines built after February 1998 are equipped with a Vehicle Electronic Control Unit (VECU), located under the fuse and relay panel. The VECU is accessible by removing the front TEC panel.

The VECU receives inputs and generates output signals for functions associated with cab devices. It also converts information into digital data to be broadcast over the J1708/J1587 Information Data Link and the J1939 Control Data Link.

Note: the VECU may also be referred to as the “Cab Controller” on the graphics display of the instrument cluster, and in some other Volvo publications.

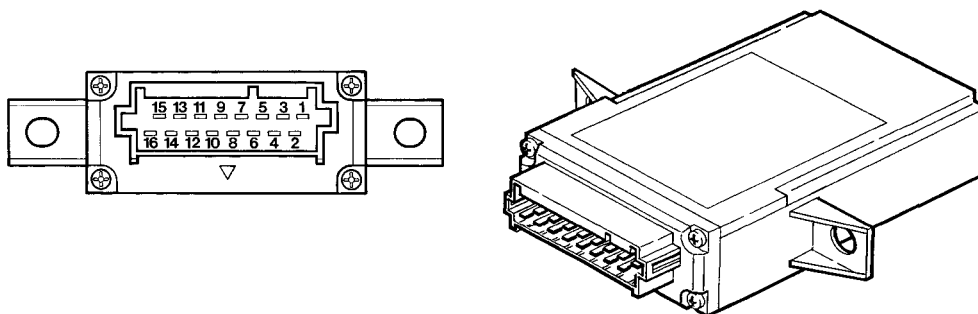
Each VECU is programmed with a specific vehicle dataset according to what the customer has ordered for that vehicle. This dataset is stored in the VECU memory, making the VECU unique to each vehicle. For this reason, it is not possible to “swap” a suspected faulty VECU with one from another vehicle without reprogramming the replacement VECU.

For more information on the design and troubleshooting of the VECU, see:

Paper Vehicle Electronic Control Unit, MID 144, PV776–TSP29763/1.

Impact Function Group: 364
Info Type: Description

Central Door Lock Module



W3000553

Central door locks are an optional feature. The central locking can be activated from either the passenger or driver side door lock. If the main supply is activated with one door locked and one unlocked, both sides will be automatically unlocked to prevent the driver from accidentally being locked out.

The Central door lock module is located in the front TEC panel, below the fuse and relay panel. The door lock module is accessed by removing the front TEC panel cover.

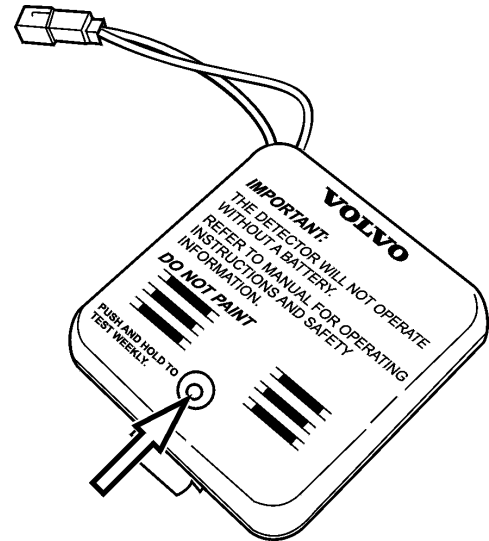
Central Door Lock Module Connector				
Pin	Circuit Number	Description	Input /Output	Characteristics
1	710	Battery+ supply voltage	I	Unswitched battery (+) supply
2	713R	To passenger side motor - unlock	O	Internally switched to GND or Unswitched Batt.
3	713L	To driver side motor - unlock	O	Internally switched to GND or Unswitched Batt.
4	714R	To passenger side motor - lock	O	Internally switched to GND or Unswitched Batt.
5	714L	To driver side motor - lock	O	Internally switched to GND or Unswitched Batt.
6 7		Not used		
8	712	To passenger side switch	I	Externally switched to GND or open
9	711	To driver side switch	I	Externally switched to GND or open
10 11 12 13 14 15		Not used		
16	0C-C	Battery ground	I	Battery GND

Smoke Detector

VN sleeper cabs may be equipped with an optional smoke detector. If equipped, the smoke detector will be located on the sleeper headliner. The smoke detector includes an alarm and indicator light / test button. The chart below gives the indicator lamp and alarm operation for the conditions listed.

Operation Mode	Indicator Lamp	Alarm
Normal	Flashes every 45 seconds	Silent
Alarm Active	Flashes continuously	Pulsating
Low Battery Warning	Flashes every 45 seconds	Beeps every 45 seconds
Timer Mode	Flashes every 10 seconds	Silent

A 9-volt battery powers the smoke detector. The “low battery” indicator should sound approximately one month before the battery is depleted. To test the battery, press and hold the test button for approximately 5 seconds. If the battery is OK the alarm will sound as long as the test button is pressed. Always test the alarm for proper operation after the battery has been replaced.

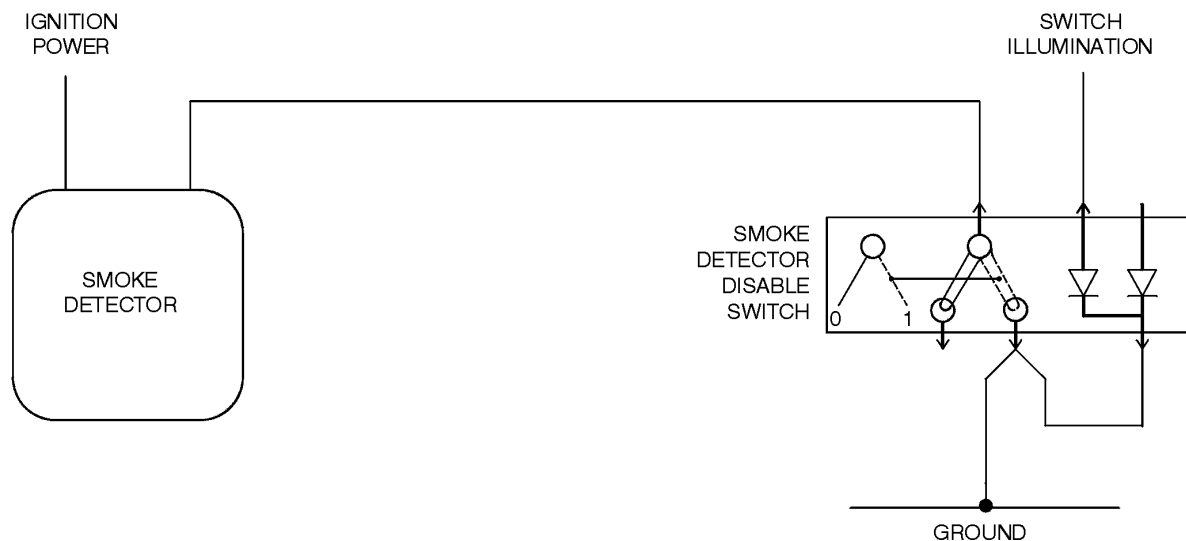


W8002731

Fig. 90: Smoke Detector Indicator Lamp / Test Button

The smoke detector alarm may be erroneously activated by cigarette smoke, dust, exhaust fumes, etc. In these cases, the alarm may be temporarily silenced by pressing the test button or the disable switch on the left side of the dash. This initiates the timer mode, in which the alarm is silenced for 10 minutes, then goes back to normal operation. The timer mode can be initiated with the smoke detector in normal operation mode or after the alarm has been activated.

The simplified schematic below should only be used to clarify the design of the smoke detector. For detailed, vehicle specific schematics, see "VN or VHD Series Electrical Schematics, Group 37."

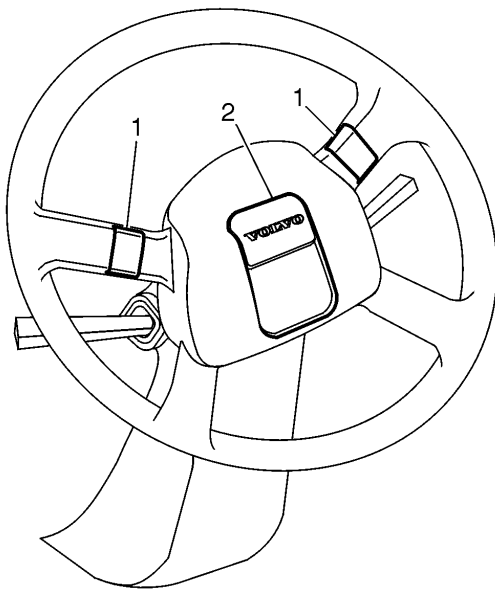


W3004348

Fig. 91: Smoke Detector, Simplified Schematic

Horn

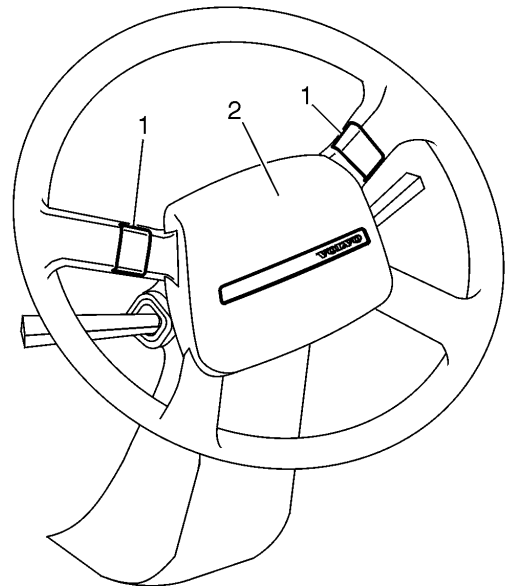
Both city and air horns are standard equipment on VN/VHD vehicles. The air horns may be located on the roof, inside the right frame rail near the radiator, or on the left frame rail near the batteries. The city horn is located at the left front of the vehicle near the radiator. Both horns are operated by steering wheel controls. The city horn operates by pressing buttons on either the left or right steering wheel spoke. The air horn is electrically operated via a remote solenoid. The air horn button is the one in the center of the steering wheel on non-SRS equipped vehicles. On SRS equipped vehicles, the entire air bag module acts as the air horn button.



W8002736

Fig. 92: Steering Wheel, Without SRS

- 1 City Horn
- 2 Air Horn



W8002735

Fig. 93: Steering Wheel, With SRS

- 1 City Horn
- 2 Air Horn

The simplified schematic below should only be used to clarify the design of the horns. For detailed, vehicle specific schematics, see "VN or VHD Series Electrical Schematics, Group 37."

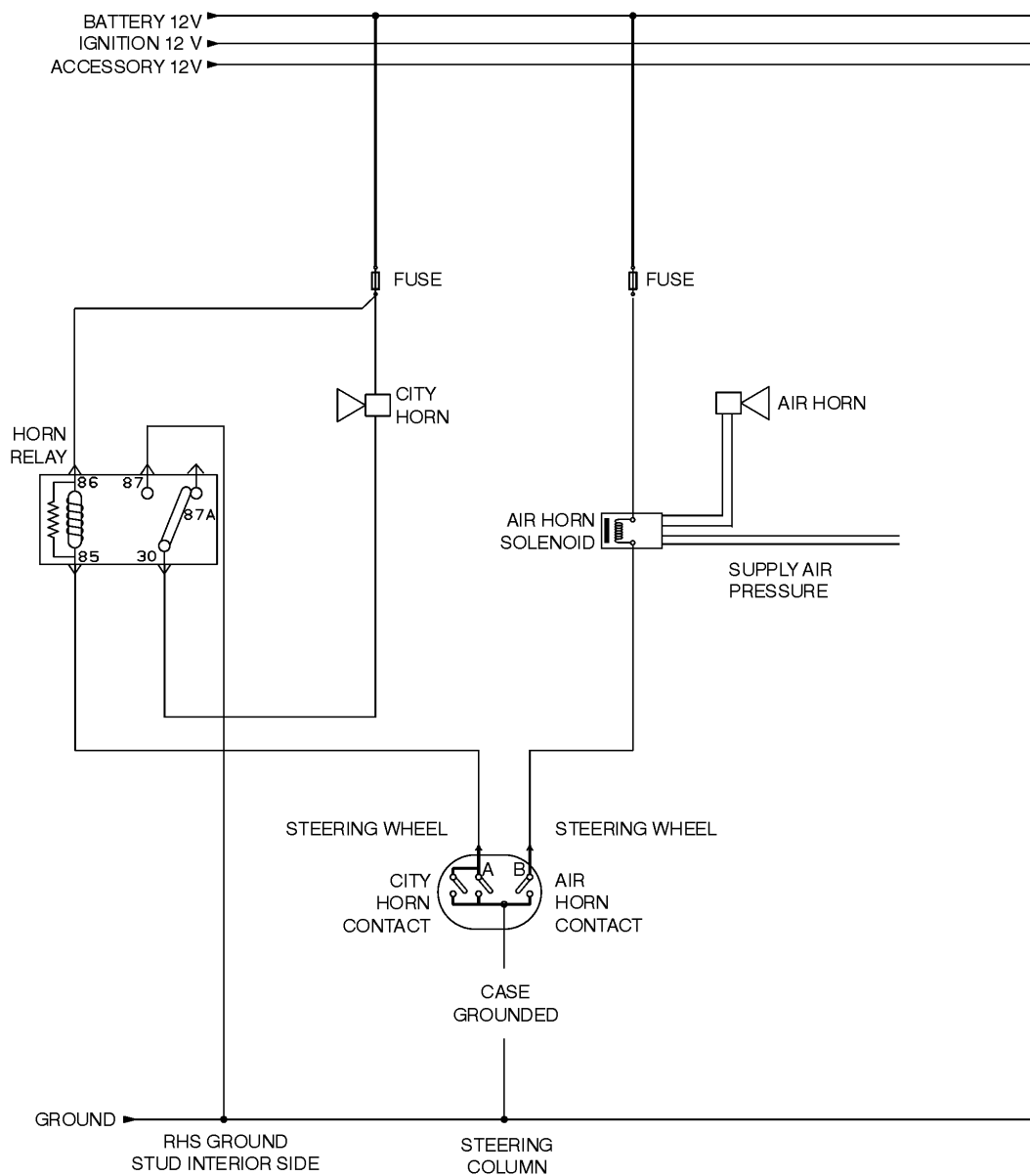


Fig. 94: Horns, Simplified Schematic

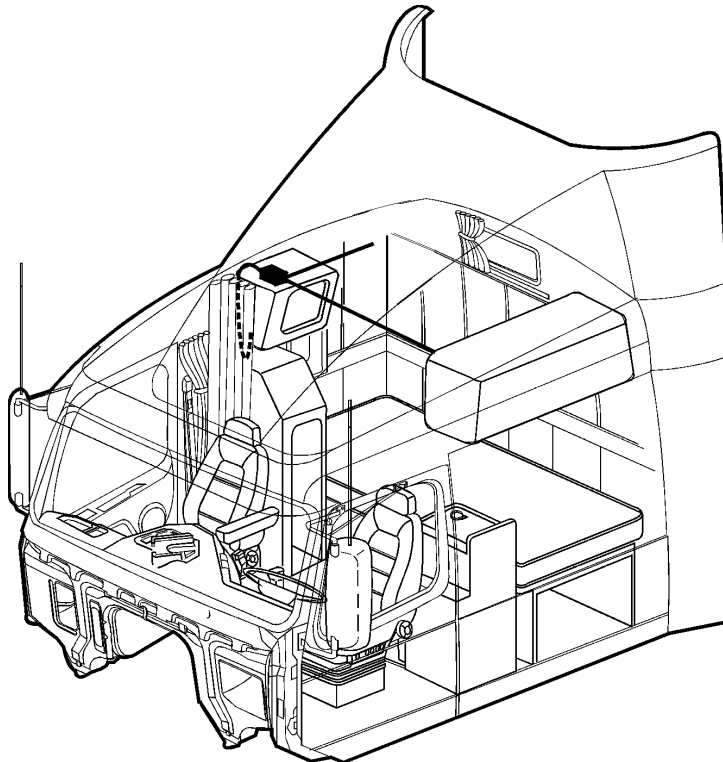
W3004340

TV Antenna and Speaker

A TV Prep Kit, including an antenna and coaxial cable, is standard for the VN770 cab and optional in the 610 and 660 cabs. The coaxial cable extends from the antenna in the headliner and runs behind the cabinets on the passenger side. It should be connected to a television, located in the cabinet on the passenger side.

The antenna is installed under the center headliner of the bunk area.

In the VN610 or 660, the antenna is a "ribbon" type that is taped to the underside of the SMC roof panel in the bunk area. In VN770 vehicles built after June 2000, the antenna is the same style as in the VN610 or 660.



W3004004

Fig. 95: VN610/660/770 TV Antenna

On 770 vehicles built before June 2000, the television antenna is a flexible grid type antenna and is integrated into the center bunk headliner. See Fig. 96: VN770 TV Antenna (in vehicles built prior to June 2000) page 62. A coaxial cable extends from the antenna in the center bunk headliner and runs behind the cabinets on the passenger side. It is connected to a television, located on the middle shelf of the cabinet on the passenger side.

The 770 also includes a remote TV speaker that is integrated into the sleeper control panel. For replacement instructions, see "TV Speaker/Headphone Jack, Replacement" page 139.

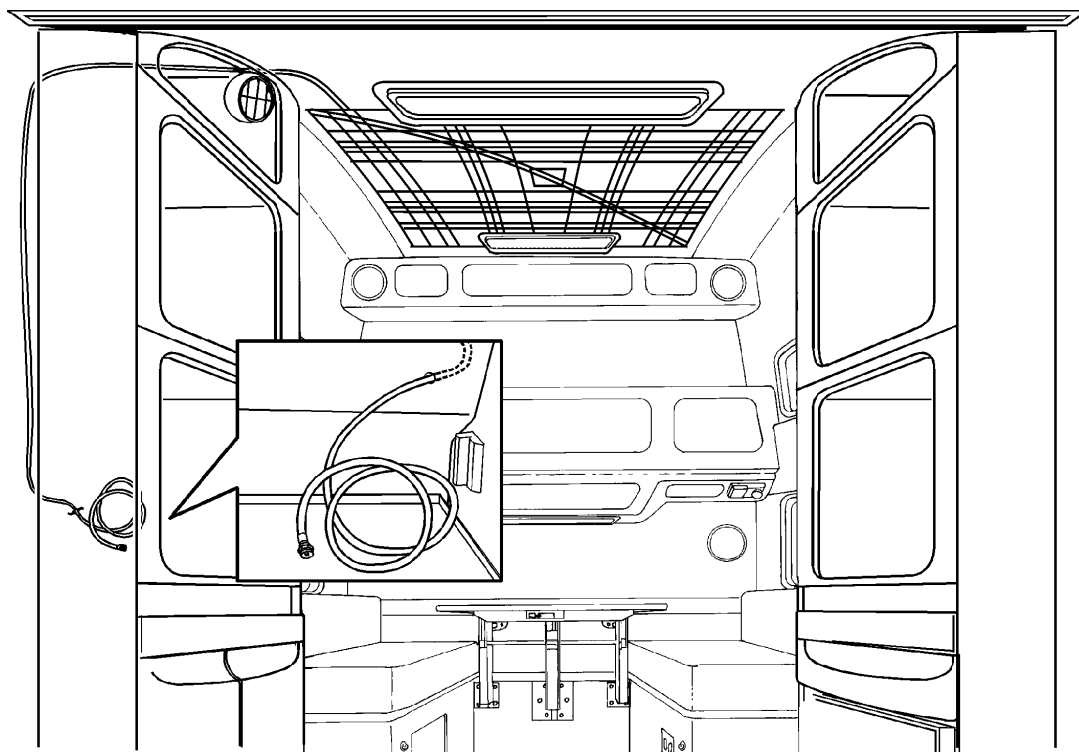
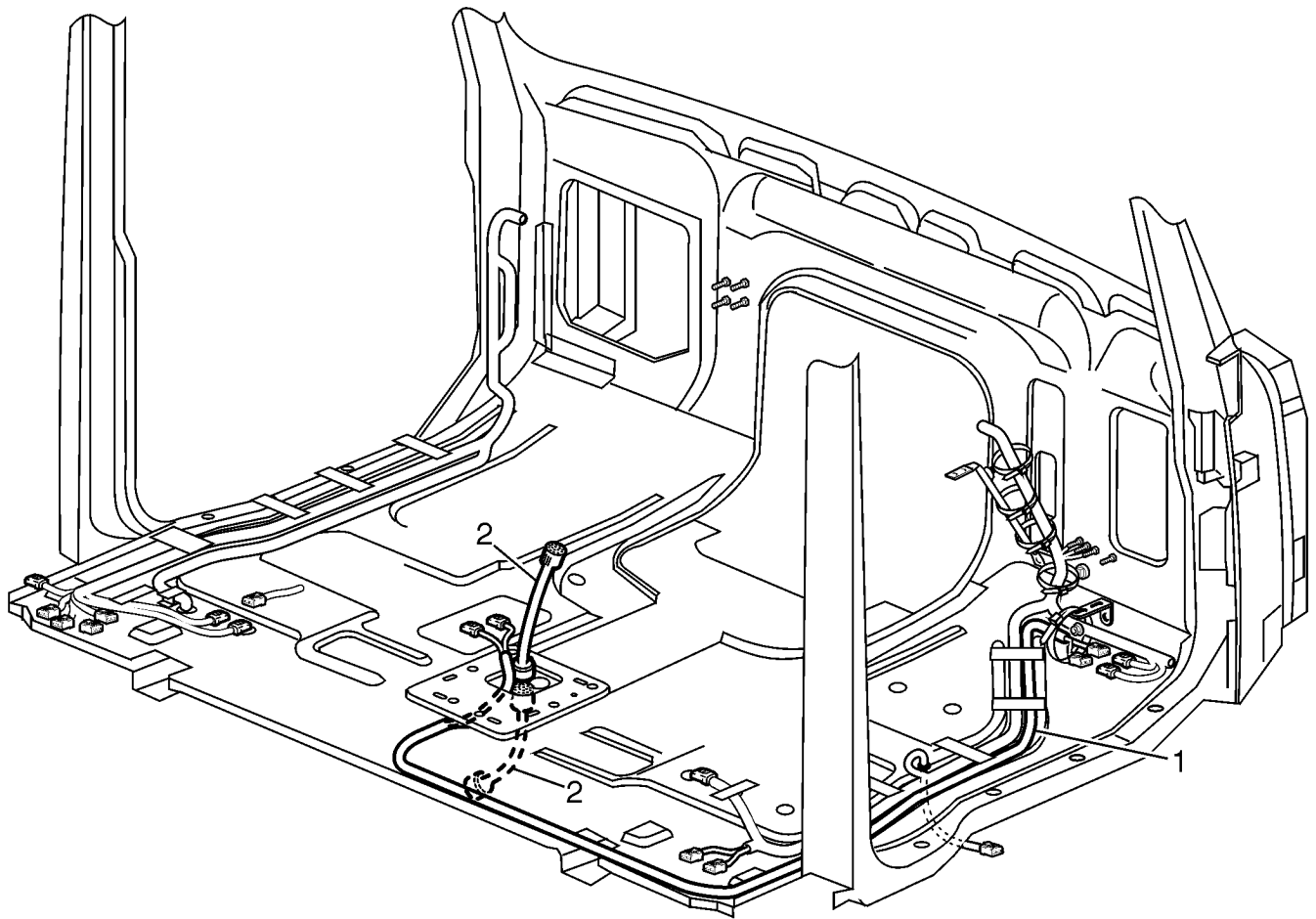


Fig. 96: VN770 TV Antenna (in vehicles built prior to June 2000)

W3004005

For more information on TV antenna troubleshooting and replacement, see TV antenna information in Group 39.

Bodybuilder Wiring



W3004424

Fig. 97: Bodybuilder Prep Kit Wiring

A Bodybuilder Prep Kit is standard in VHD truck models, and optional on tractors. It consists of the harnesses shown.

1 One jumper harness off the main cab harness. It runs from the A-pillar to the center of the cab. It routes along the right side of the cab floor to the back of the cab, then across to holes in the center of the cab where a console can be mounted. The circuits provided are listed in “Circuits in Bodybuilder Harness” page 64. Either 2 or 4 connectors will be used at each end of this harness: 4 with Allison transmissions and 2 with other transmissions. This harness allows the bodybuilder easy access to circuits in the main cab harness. For connector pin-outs, see the wiring diagrams in VHD Electrical Schematics, Group 37.

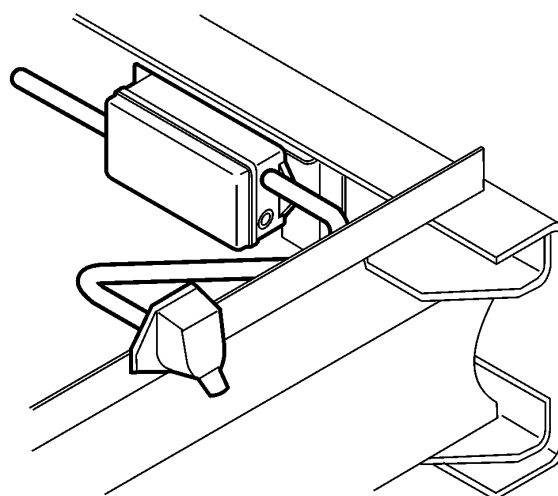
2 Two identical harnesses for the center cab console, one inside the cab and one that goes to the outside. These have 31-pin Deutsch connectors on both ends, with 14 wires installed in each. These 14 wires can be used for any circuit the bodybuilder needs to install.

Circuits in Bodybuilder Harness

Circuit #	Description
BAT-A	25 amp fused battery circuit
IGN-X	15 amp fused ignition circuit
IGN-Y	15 amp fused ignition circuit
IGN-Z	15 amp fused ignition circuit
410-B	Reverse circuit
19	"R" terminal
0T-C	Ground
NEU	Neutral signal from Allison Transmission
573	Speed Control from Vehicle ECU
573A	PTO enable from Vehicle ECU
573B	PTO enable from Vehicle ECU
573C	PTO enable from Vehicle ECU
A312NC	PTO from Allison Transmission
A312NO	PTO from Allison Transmission
A312CM	PTO from Allison Transmission

Circuit #	Description
A118	PTO from Allison Transmission
A153	Auto Neutral from Allison Transmission
A117	Auto Neutral from Allison Transmission
A314NO	Auto Neutral from Allison Transmission
A314NC	Auto Neutral from Allison Transmission
A314CM	Auto Neutral from Allison Transmission
A143-L	Auto Neutral from Allison Transmission
A161-A	Auto Neutral from Allison Transmission
A157	Allison Transmission
A155	Allison Transmission
A166	Allison Transmission
A167	Allison Transmission
A177	Allison Transmission
A178	Allison Transmission

Bodybuilder Lighting Junction Box

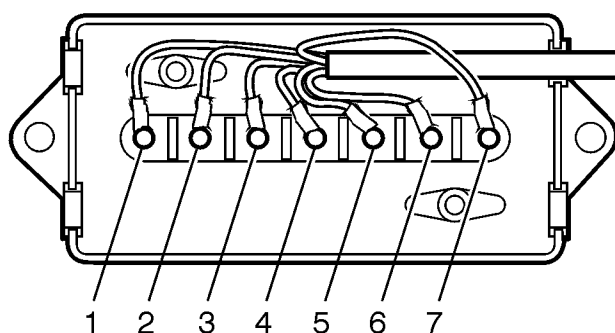


W3004413

Fig. 98: Bodybuilder Junction Box and Trailer Receptacle, End of Frame Installation

A junction box at the back of the cab is also standard in VHD models. It is usually mounted on the left side, under the cab. It may optionally be located at the end of the frame, or a trailer receptacle may be installed.

The junction box contains the same 7 wires for rear circuits as the trailer receptacle. The Volvo circuit numbers for the standard wire colors are listed below.



W3004412

Fig. 99: Bodybuilder Junction Box, Inside View

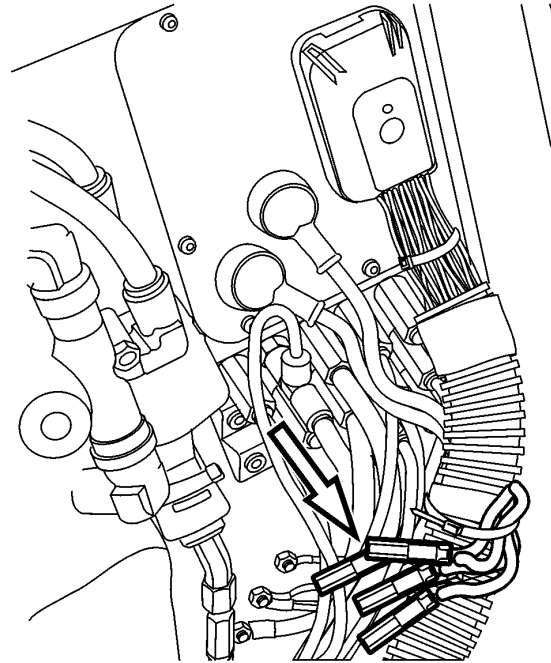
	Color	Circuit #	Description
1	White	OT	Ground
2	Black	53	ICC Trailer Marker
3	Yellow	112	LH Turn Signal Light
4	Red	72	Stop Lights
5	Green	113	RH Turn Signal Light
6	Brown	51	Trailer Marker and Tail Lamps
7	Blue	Aux	Auxiliary (12V ignition power)

Bodybuilder Option Connectors

Four bodybuilder option connectors are in the cab and engine harnesses. These wires provide a pass-through for add-on wiring from the engine compartment to inside the cab.

They are single wires, with plugged connectors, circuit numbers 999A, 999B, 999C, 999D. They are located near the engine pass-through on the engine side, and inside the dash on the cab side.

For more information, see Bodybuilder service information in Group 9.



W3004414

Fig. 100: Option Connectors, Driver Side Engine Compartment

Troubleshooting

Electrical System Troubleshooting

- “Troubleshooting Using a Digital Multimeter” page 67
- “Troubleshooting Wiring and Connectors” page 68
- “Switch Troubleshooting” page 77
- “Electronic Control Unit (ECU) Troubleshooting” page 77

Electrical System

Troubleshooting Using a Digital Multimeter

A Digital Multimeter (DMM) is one of the most important tools available for electrical troubleshooting. A multimeter such as a Fluke 87 is recommended for troubleshooting. It provides diagnostic capabilities such as current (amperage), resistance and voltage tests, as well as specialized features for automotive troubleshooting.

Always consult the DMM manufacturer instructions for the proper use of the meter before beginning testing.

Before using the DMM to measure resistance, check its calibration by touching the leads together. If there is a reading other than zero, subtract it from measurements made with the DMM.

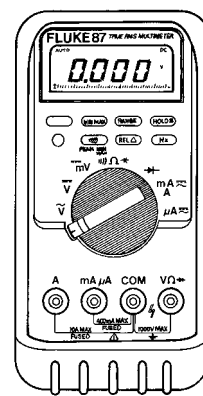


Fig. 101: Fluke 87 Digital Multimeter

Available from Volvo (P/N 9510060)
or Kent-Moore (J-39200)



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



CAUTION

Never use the ohmmeter mode of the DMM in a powered circuit, or as a substitute for a voltmeter or ammeter, since damage to the instrument will result. Use the ohmmeter mode only when power is removed from the circuit.

Troubleshooting Wiring and Connectors

General Troubleshooting Procedures

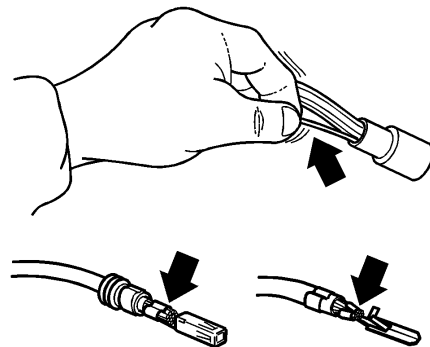
General Troubleshooting +Procedures

- Use Multimeter J-39200 (or equivalent tool) to perform tests. The use of test lights is discouraged.
- When troubleshooting wiring and connectors use breakout boxes/harnesses when available. A list of various breakout boxes/harnesses is included in "Special Tools" page 7.
- Never pierce the wiring insulation with test probes.
- Do not pierce through seals on water-resistant connectors.
- Never insert test probes into connectors. The probes may spread the terminals and cause intermittent faults.
- If breakout boxes/harnesses are not available, contact the metal outer edges of connector terminals as necessary to take readings.
- Consult "VN or VHD Series Electrical Schematics" in Group 37 for vehicle specific wiring and connector information. These schematics include pin-out and vehicle location drawings for connectors.

Visual Inspection

Before beginning electrical checks, visually inspect the wiring and connectors.

- Inspect for corrosion in wiring or connectors. See "Corrosion" page 74.
- Check that terminal pins are not bent or damaged, locked into their connectors, and properly crimped.
- Check that the terminal pins make good mechanical contact with their mating pin. See "Contact Problems" page 75.
- To help locate intermittent faults, wiggle the wire and connector while testing.

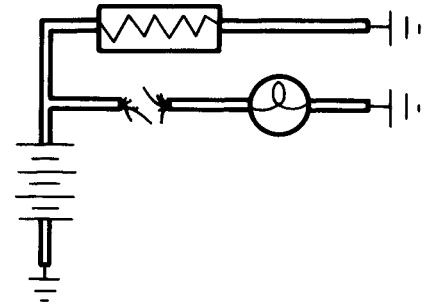


T3009648

Open Circuit

Whenever there is a complete break or interruption in the normal current path, such as a break in wiring from the source of power to the electrical unit or within the unit itself, current will not flow. In a circuit, current normally travels through the wires or cables, to switches and electrical unit(s), such as the starter solenoid and cranking motor, through another wire to ground and back to the source.

A break anywhere along this route results in an open circuit and the complete loss of power. An ammeter will not register at all because there cannot be current flow through an open circuit. A voltmeter, depending on where it is placed in relation to the open circuit, may or may not give a reading.



W3000489

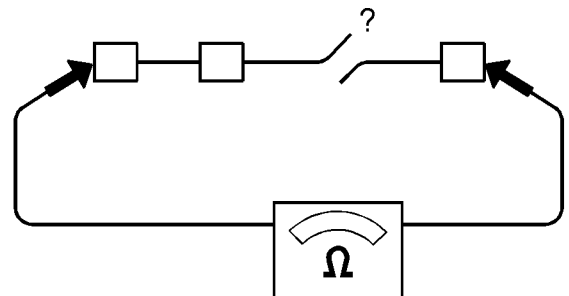
Checks



CAUTION

Possible damage to electric/electronic components. Turn the vehicle OFF before connecting or disconnecting electrical components. Failure to de-energize circuits may result in electronic equipment damage.

- 1 Visually inspect the circuit.
- 2 Disconnect the connectors at both ends of the wiring harness.
- 3 Measure resistance using multimeter J-39200 (or equivalent tool) between the ends of the wire. The expected value is $<1\ \Omega$. Readings of "OL" (infinite resistance) indicate an open circuit. If an open circuit is detected, disconnect and test progressively smaller lengths of the circuit until the faulty wiring is located.
- 4 Test for intermittent faults by wiggling the connectors and/or wiring while monitoring the meter.



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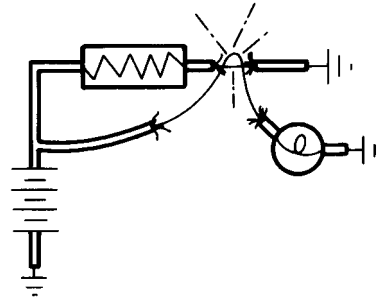
Short Circuit

The term short circuit is used to describe another type of condition which can develop in electrical circuits or units. It refers to a circuit that is completed in the wrong way, such as two bare wires touching each other, so that the current bypasses part of the normal circuit.

If the short circuit is to a ground wire this can result in blown fuses, open circuit breakers, wiring or component overheat, burned parts and insulation and of course non working components.

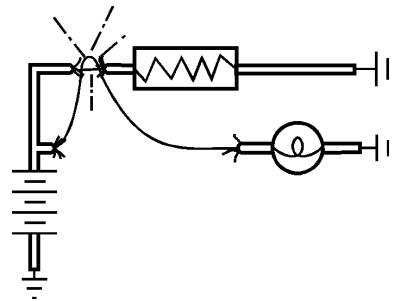
Hot, smelly insulation is always a sign of trouble. If the wire melts through, there is no electrical path, so the circuit then becomes open.

If the short circuit is to a power wire it can result in components operating at inappropriate times. This occurs because power that normally should be supplied by one component switch or circuit is bypassed by the short circuit and power is supplied by a different switch or circuit.



W3000490

Short circuit to ground



W3002836

Short circuit to power wire

Checks – Short circuit to ground

- 1 Visually inspect the circuit.
- 2 Turn ignition key to “ON” or “ACCESSORY” as necessary.
- 3 Activate the suspect circuit and check if the fuse blows or if there is excessive current draw.
- 4



CAUTION

Possible damage to electric/electronic components. Turn the vehicle OFF before connecting or disconnecting electrical components. Failure to de-energize circuits may result in electronic equipment damage.

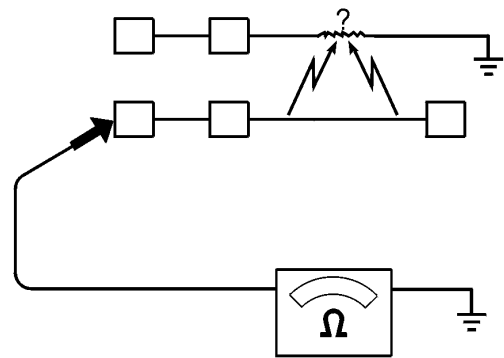
Turn the ignition key to “OFF”. Disconnect the connectors at both ends of the wiring harness.

- 5 Measure resistance using multimeter J-39200 (or equivalent tool) between the end of the wire and ground. The expected value is “OL” (infinite resistance). Low resistance readings may indicate a circuit shorted to ground. If a short circuit is detected, disconnect and test progressively smaller lengths of the circuit until the faulty wiring is located.
- 6 Test for intermittent faults by wiggling the connectors and/or wiring while monitoring the meter.



CAUTION

Do not check a short circuit by using a jump wire across the fuse, terminals or by installing an oversized fuse in the fuse panel. This could cause damage to the electrical system.



W3003970

Checks – Short circuit to power

- 1 Visually inspect the circuit.
- 2 Turn ignition key to "ON" or "ACCESSORY" as necessary.
- 3 Activate the suspect circuit and check to see if another inappropriate circuit operates at the same time.

4

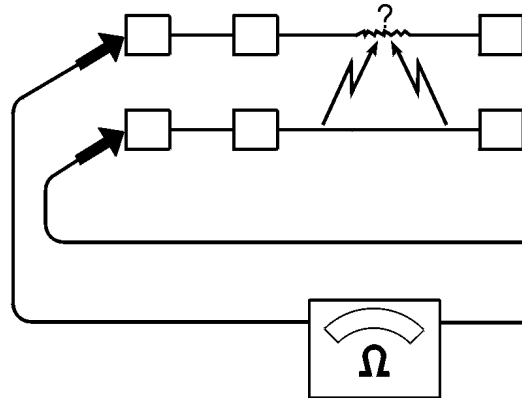


CAUTION

Possible damage to electric/electronic components. Turn the vehicle OFF before connecting or disconnecting electrical components. Failure to de-energize circuits may result in electronic equipment damage.

Turn the ignition key to "OFF". Disconnect the connectors at both ends of the wiring harness of each affected circuit.

- 5 Measure resistance using multimeter J-39200 (or equivalent tool) between the ends of the wires of each affected circuit. The expected value is "OL" (infinite resistance). Low resistance readings may indicate the circuit shorted together. If a short circuit is detected, disconnect and test progressively smaller lengths of the circuit until the faulty wiring is located.
- 6 Test for intermittent faults by wiggling the connectors and/or wiring while monitoring the meter.

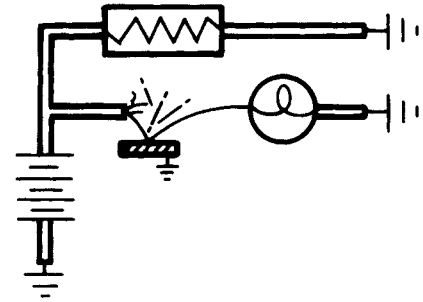


W3003969

Grounded Circuit

A grounded circuit is similar to a short circuit in that the current bypasses part of the normal circuit. In this instance, the current flows directly to ground. This may be caused by a wire touching ground or part of the circuit within a unit coming in contact with the frame or housing of the unit.

A grounded circuit may also be caused by deposits of oil, dirt and moisture around connections or terminals.



W3000491

Checks

- 1 Visually inspect the circuit.
- 2 Turn ignition key to "ON" or "ACCESSORY" as necessary.
- 3 Activate the suspect circuit and check if the fuse blows or for excessive current draw.
- 4



CAUTION

Possible damage to electric/electronic components. Turn the vehicle OFF before connecting or disconnecting electrical components. Failure to de-energize circuits may result in electronic equipment damage.

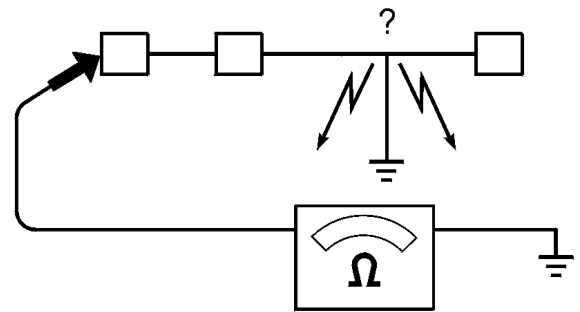
Turn the ignition key to "OFF". Disconnect the connectors at both ends of the wiring harness.

- 5 Measure resistance using multimeter J-39200 (or equivalent tool) between the end of the wire and ground. The expected value is "OL" (infinite resistance). Low resistance readings may indicate a grounded circuit. If a grounded circuit is detected, disconnect and test progressively smaller lengths of the circuit until the faulty wiring is located.
- 6 Test for intermittent faults by wiggling the connectors and/or wiring while monitoring the meter.



CAUTION

Do not check a short circuit by using a jump wire across the fuse, terminals or by installing an oversized fuse in the fuse panel. This could cause damage to the electrical system.



W3003968

High Resistance

A high resistance condition in a circuit is often difficult to find. Symptoms of high resistance include dim or flickering lamps or inoperative components (since current decreases when resistance increases, the components may not be receiving enough current to operate properly).

The first step in finding a high resistance problem should be a visual check of all connectors and wires in the circuit.

Possible cause of High Resistance:

- A chafed cable where one or more wires have been cut, effectively reducing the diameter of the wire.
- An inadequate power or ground path due to corrosion, loose terminals or fasteners.
- A terminal that is worn due to excessive cycling (connecting, disconnecting).
- An internal component fault.

Corrosion

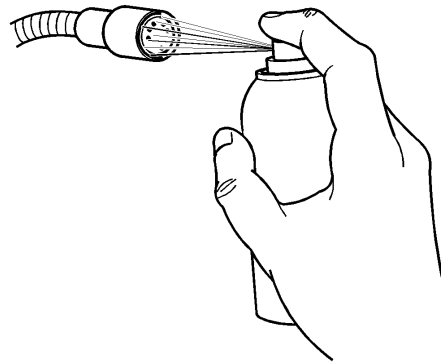
Corrosion in sockets and connectors is caused by acids and road salt reacting with the copper. Connections exposed to concentrated splash, spray and wheel wash should be sealed tightly. Periodically check to see that all wiring connections are clean and tight.

Corrosion in wiring is due mainly to poor wire splicing or breaks in the wire insulation. Wires should not be spliced by twisting them together and wrapping with tape. Several hand crimped connectors are available on the market which will result in a good joint or union, but most do not provide a water tight seal.

Corrosion is also caused by terminals that are improperly fastened to the vehicle. Excessive vibrations at the contact points will cause fretting corrosion.

Corroded wires should be replaced as needed. Corroded terminals should be cleaned with wire brushes or scraped as needed to remove corrosion. It's important to also check for corrosion in the wire if a terminal is corroded. The wire can act like a wick and absorb moisture. Additionally, terminals may be cleaned with cleaning chemicals designed for electronic terminal cleaning, and then blown dry with compressed air. But there is a risk of forcing the moisture further into the terminal or cable.

After cleaning, closely inspect the terminals to determine their serviceability. Check for proper contact as outlined in "Contact Problems" page 75. Replace any connectors that are determined to be in less than serviceable condition.



T3009652

Contact Problems

Loose or corroded connections are often the cause of intermittent faults. Intermittent faults are usually difficult to find since the fault must be active at the time of troubleshooting to insure that the fault is corrected. Wiggling the suspected wiring or connector while monitoring the circuit function or multimeter may be effective in helping to locate intermittent faults.

To check for proper contact on terminal pins begin by visually inspecting the connector.

For the Volvo engine ECU connector pins, use gauge 9998482 (found in kit 3947553) to check for proper contact.

- Insert the gauge into the terminal.
- Move the gauge in and out of the terminal to check that the terminal has proper clamping force on the gauge.

If the terminal does not have any clamping force, is weak, or loose the terminal must be replaced. To replace the terminal, see "Engine ECU Terminal, Replacement" page 79.

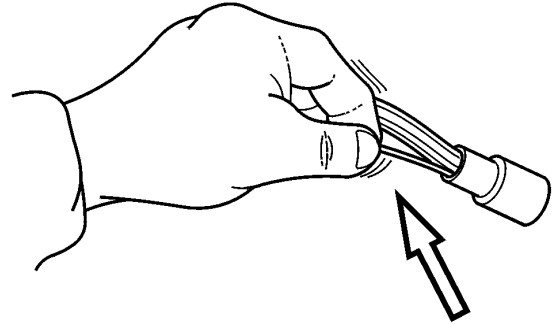
For the JAE connector pins used on Vehicle ECUs and the instrument cluster use tool J-42449-1 (found in kit J-42449) to check for proper contact.

- Insert the gauge into the terminal.
- Move the gauge in and out of the terminal to check that the terminal has proper clamping force on the gauge.

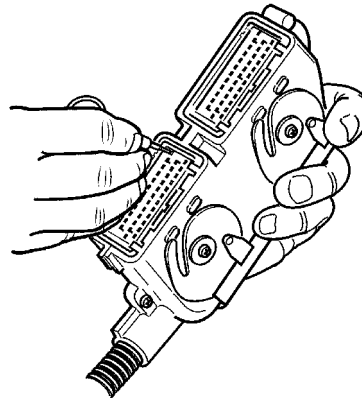
If the terminal does not have any clamping force, is weak, or loose the terminal must be replaced. To replace the terminal, see "JAE Terminal, Replacement" page 81.

For other types of terminal pins or connectors, use a new mating terminal of the correct type to check for proper contact. Several types of terminals can be found in kits 3947553, 3949522 and 3949523. If the terminal does not have any clamping force, is weak, or loose the terminal must be replaced.

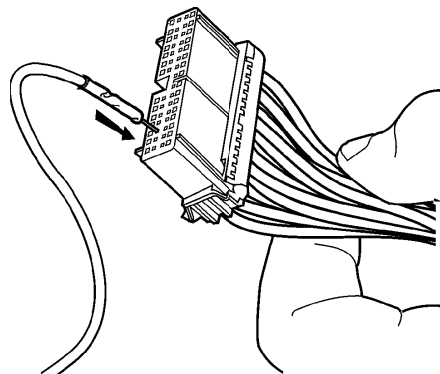
Note: Excessive use of the test gauge will degrade the clamping force of the mating terminal and may cause additional intermittent faults.



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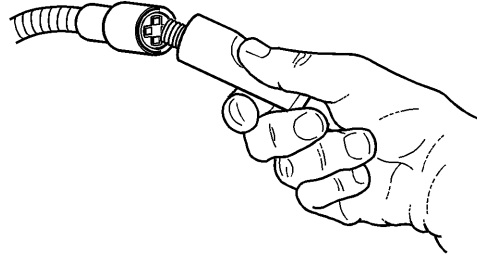
W3003966



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Dielectric Grease

The use of dielectric grease is recommended for certain **non-sealed** plugs, sockets, and connectors that are exposed to the weather. It reduces corrosion by providing protection against moisture and the elements. Sealed connectors do not require dielectric grease.

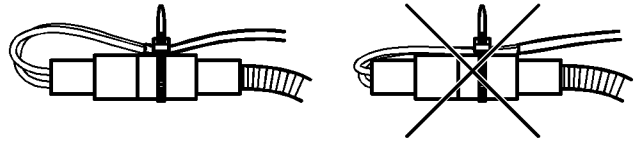


Routing and Clipping

Wiring should be secured as necessary to prevent rubbing against objects that may wear through the wiring insulation and cause circuit failures.

When securing wiring near connectors, switches, or sensors with cable ties, leave some slack at the connector to prevent vibration from pulling the wiring out of the connector.

T3009653



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CAUTION

If a circuit must be added to the electrical system, and will carry high currents or frequencies, route it in a location AWAY from the J1587 data link wires 400 and 401, and the J1939 wires 406, 407 and 408, to prevent mutual inductance from interfering with data link functions.



CAUTION

No modifications or connections should be made to wires 406 (yellow), 407 (green), or 408 (shielded). These wires carry the high speed communications between the electronic systems in the vehicle. **Any modification, connection to, or damage to these wires can result in the failure of the vehicle's electronic systems.**



CAUTION

Wires 400 and 401 **MUST NOT** be cut or spliced for any connections. These wires are used for the transmission of data for diagnostic messages and gauges. Modifying this circuit can cause these functions to fail.

Switch Troubleshooting

Checking the continuity between pin or cavity positions in various operating positions may help troubleshoot switches. The switch detail information in “Switch Logic Diagrams” page 37 or in the electrical schematics may be used as a guide when checking for proper switch operation.

Troubleshooting information on specific switches may also be found in various service information that deals with specific components or systems.

Electronic Control Unit (ECU) Troubleshooting

Generally there is no actual testing of electronic control units or electronic modules. Electronic control unit/module connector wire input or output may be tested, but caution must be used not to introduce problems where none exist. Simple troubleshooting of such things as power and ground supply or sensor continuity may be attempted with the ECU disconnected.

If tests exist for an ECU, the details of those tests will be covered in the service procedures for that ECU.

Service Procedures

Engine ECU Terminal, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

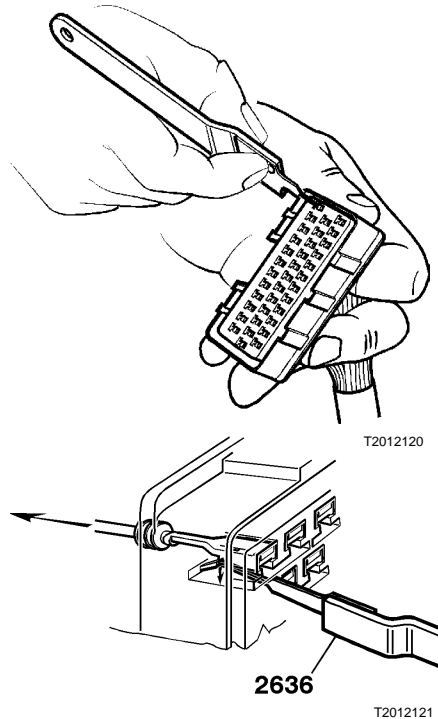
Note: The tools used in this procedure can be found in repair kit: 3947553

Special tools: 9512636, 9998482, 1078054

1

Remove the screws for the connector housing locking clamp and the connector housing. Cut the tie strap fastening the wiring harness to the connector housing.

2

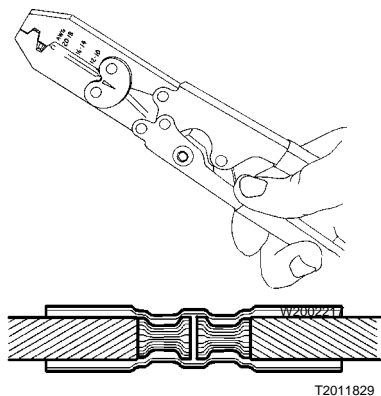


Remove the terminal locking plate from the connector. Remove the faulty terminal from the connector using tool 9512636 (from VE D12 Engine Kit 3947553).

9512636

3

Remove the tape from the wiring harness and conduit. Cut the wire that has the faulty terminal to the correct length for proper installation.

4

Strip the insulator back on the end and crimp the replacement terminal splice 1078054 (from VE D12 Engine Kit 3947553). Crimp the butt splice connector housing crimpers 3947557 (Packard crimpers 12085115) in the 18-20 anvil.

Pull gently on the connection to check for a proper crimp.

1078054
, 3947557

5

Use heat gun J-25070 (or equivalent tool) on the butt splice insulator until the insulator shrinks around the wire and sealant is visible to ensure the connection is sealed.

J-25070

6

Insert the terminal into the connector until it locks. Pull on the wire gently to insure the terminal is locked. Install the terminal locking plate in the connector.

7

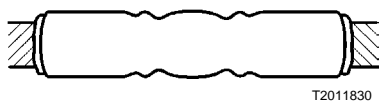
Tape the wire harness and conduit from where the tape was removed.

8

Install the tie strap, fastening the wire harness to the connector housing. Install the screws for the connector housing and clamp.

9

Insert the connector back into the control unit and lock the clamp.



JAE Terminal, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

JAE connectors are used on the Vehicle ECU (VECU) and on the instrument cluster. To replace faulty terminals in these connectors use the butt splice connectors listed below (available from Volvo):

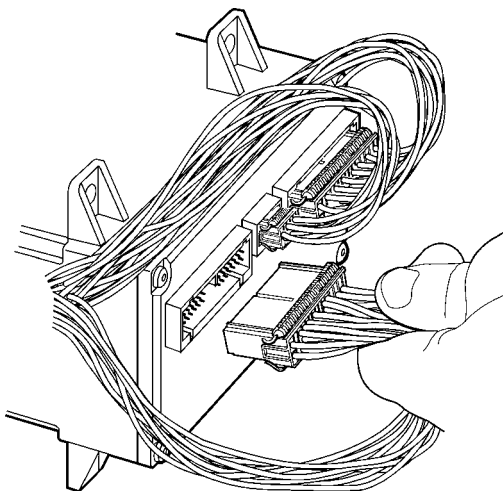
- 3948725 (for black, numbered wires)
- 3978726 (for ground wires)

Special tools: 3949522, J-42449, J-38125-8, J-25070

Removal

1

Disconnect the JAE connector with the faulty terminal from the component.

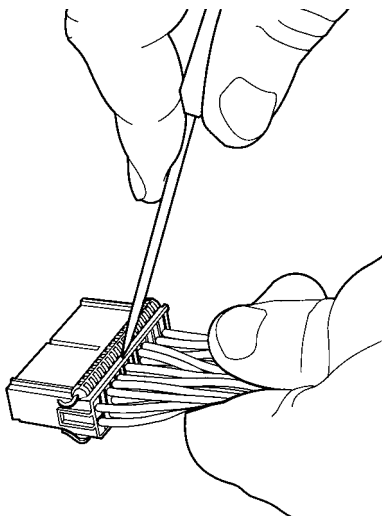


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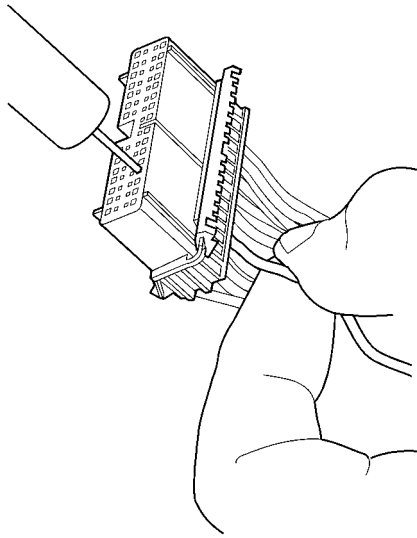
2

Carefully pry open the lock on the male portion of the connector using a small flat screwdriver.

Note: The lock is not easy to see. To open the lock, pry just under the top ledge of the connector (see figure).



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W3002867

3

Remove the faulty terminal from the connector as follows, using the removal tool from kit J-42449.

Note: In each of these JAE connectors there are two rows of terminals, and two rows of release holes. The release holes are slightly larger than the ones containing terminals.

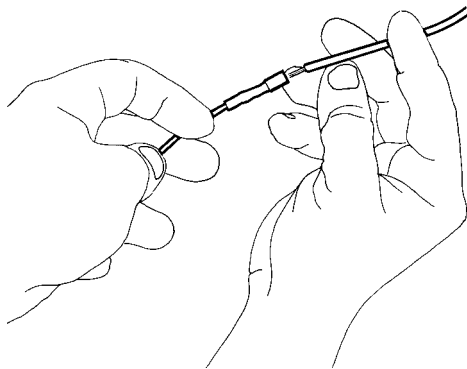
Insert the removal tool into the release hole above the terminal being removed. It will take some pressure to make the terminal locks release.

J-42449

Installation

1

Cut the faulty terminal wire to the same length as the JAE terminal pigtail replacement.



W3002868

2

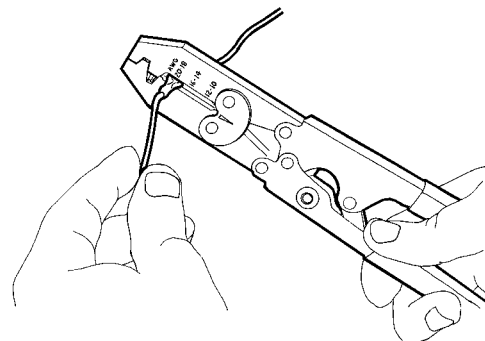
Strip the insulation back approximately 6 mm (1/4 in.) and install butt splice 3948725 (or 3948726) to the wire.

3948725
, 3948726

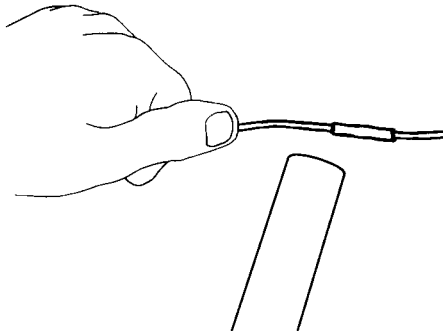
3

Crimp in the 18-20 anvil of crimper J-38125-8 (from Repair Kit 3947553). Slightly pull the wire to ensure a correct crimp.

J-38125-8



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W3002870

4

Using heat gun J-25070 (or equivalent tool), heat the splice to shrink the tubing until the adhesive is visible for a good moisture seal.

J-25070

5

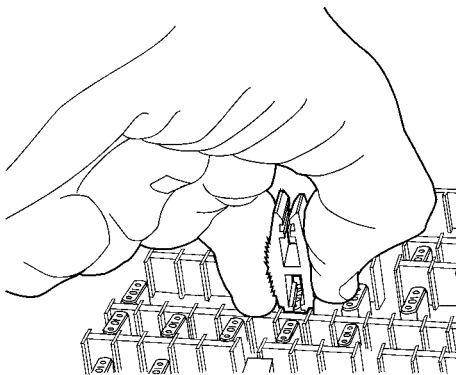
Install the terminal into the correct connector cavity. Pull back on the wire to make certain the terminal is locked into the connector. Push the connector lock back into position.

6

Connect the connector to the component and check for proper function.

Mini-fuse, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.



W3002525

1

To replace mini-fuses in the TEC, use only the fuse puller tool provided with the vehicle, 20378326. Removing the mini-fuses with another device can possibly damage the TEC panel connections.

20378326

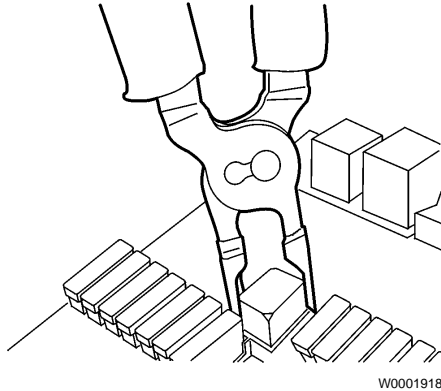
Relay, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

1

To replace relays, use relay puller tool J-43244. This tool can be used on standard size or micro-relays, power relays, DRL modules, mini-circuit breakers, maxi-fuses, etc.

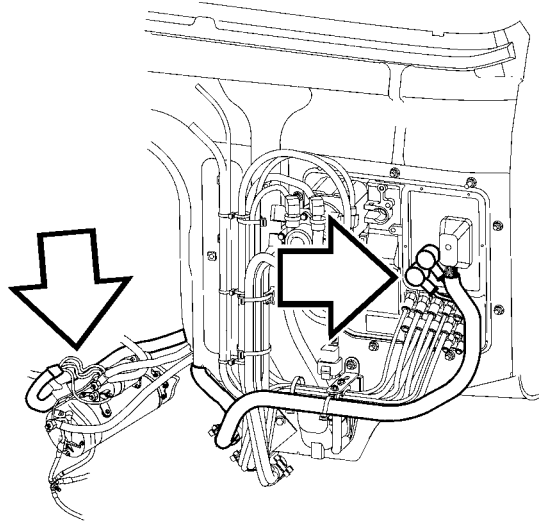
J-43244



3714-03-02-02

Fusible Link, Replacement (Battery Side)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

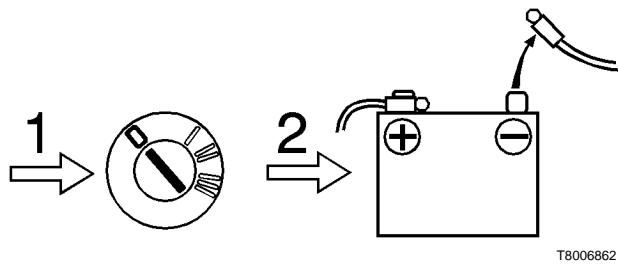


W3002563

Note: If a battery side fusible link becomes an open circuit, power will not be supplied to the cab power stud on that circuit (no continuity between the cab stud and starter solenoid).

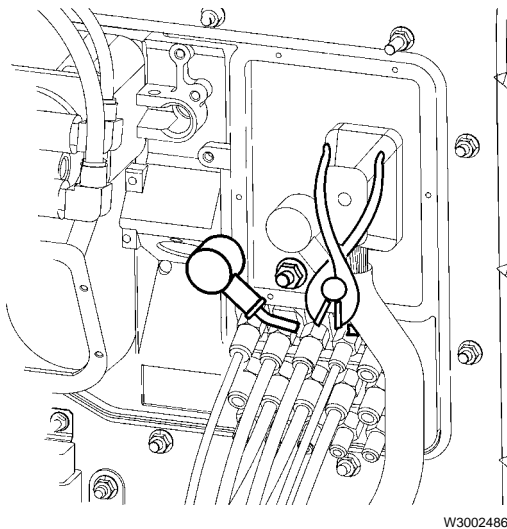
Removal

1
Turn the ignition key OFF and disconnect the negative and positive battery cables.

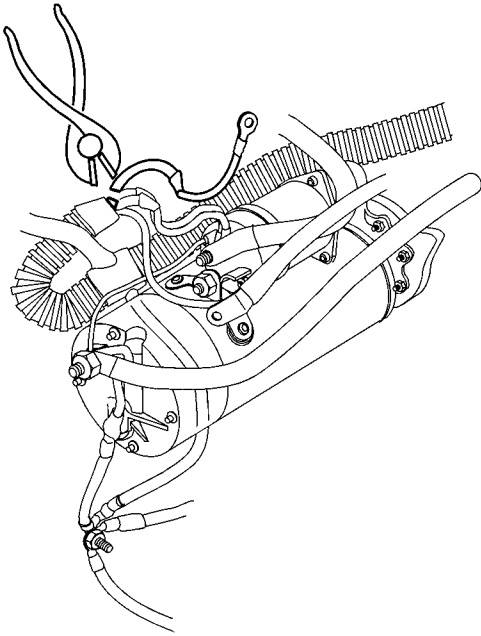


2
Remove the five torx bolts attaching the splash guard along the left frame rail. Remove the splash guard.

3
Remove the cable mounting nut from the bulkhead pass-through plate. Since there are two fusible links, check the continuity in the fusible link wire to make sure you are replacing the one that has melted. After locating the correct one, cut the wire as close as possible to the wiring harness conduit and tape to prevent future use.



4
Loosen the bolt that goes through the battery cable clamping bracket. Remove the cable from the clamp. This will allow the cable to be removed from the solenoid.



W3002564

5

Remove the nut from the starter solenoid post where the fusible link/main battery cable is attached. The melted fusible link should be noticeable. If not, check continuity to find the faulty fusible link. Cut the melted fusible link wire as close as possible to the wiring harness conduit and tape to prevent future use.

Installation**1**

Install the new fusible link by installing the eye terminal onto the bulkhead pass-through stud. Position the eye terminal with the wire down. Tighten the pass-through stud nut to 10 ± 2 Nm (88 ± 18 in-lb). Install the insulator cap.

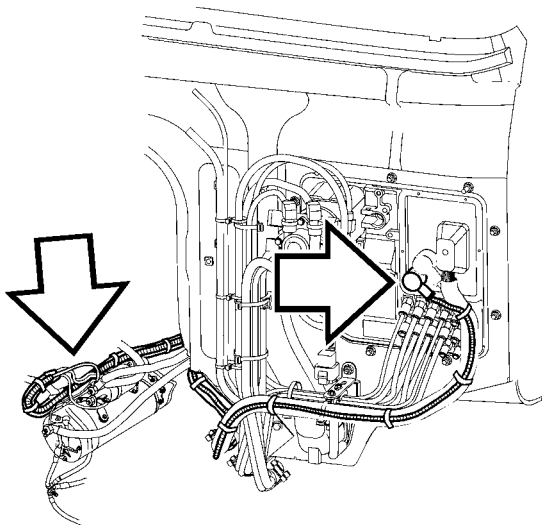
10 ± 2 Nm
(88 ± 18 in-lb)

2

Route the new fusible link along the engine wiring harness. Install the fusible link onto the starter solenoid stud, along with the other terminals that were connected before.

Tighten the starter solenoid stud nut to 27–34 Nm (20–25 ft-lb). Tie strap the new fusible link to the engine harness, making sure to trim the extra tie strap ends.

27–34 Nm
(20–25 ft-lb)



W3002565

3

Install the cable into the battery cable clamping bracket. Tighten the bolt on the bracket to 17 ± 3 Nm (150 ± 27 in-lb).

17 ± 3 Nm
(150 ± 27 in-lb)

4

Install the splash guard along the left frame rail with 5 torx bolts, and tighten to 18 ± 3 Nm (160 ± 26 in-lb).

18 ± 3 Nm
(160 ± 26 in-lb)

5**CAUTION**

In vehicles with a Supplemental Restraint System (SRS), turn the ignition switch ON before connecting the battery. Failure to do so may result in permanent damage to the instrument cluster or other electronic circuits on the vehicle. Check for fault codes after repairs are complete.

**CAUTION**

If there are other ground cables to be connected to the battery (such as engine ECU, satellite system, etc.), connect the battery ground cable **first**, then connect those grounds. Electronic modules may be damaged when additional grounds are connected/disconnected without the main battery ground connected. Always reconnect the main battery ground **first**.

Connect the battery positive and negative cables, connecting the positive cable first. Tighten nuts to 24 ± 4 Nm (212 ± 35 in-lb).

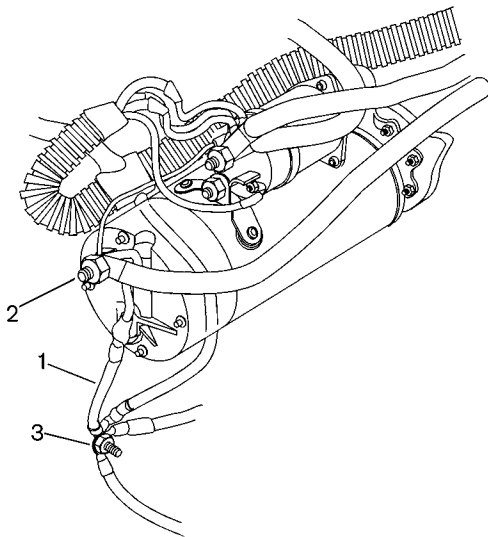
3714-03-02-01 Fusible Link, Replacement (Ground Cable)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

1

To verify ground fusible link failure, check for a visible break in the fusible link (1).

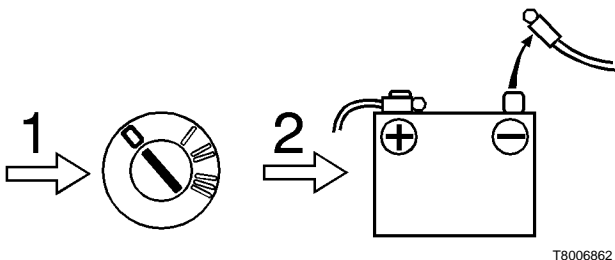


W3002567

- 1 Ground Side Fusible Link
- 2 Starter Ground Stud
- 3 Engine Ground (location varies by engine)

2

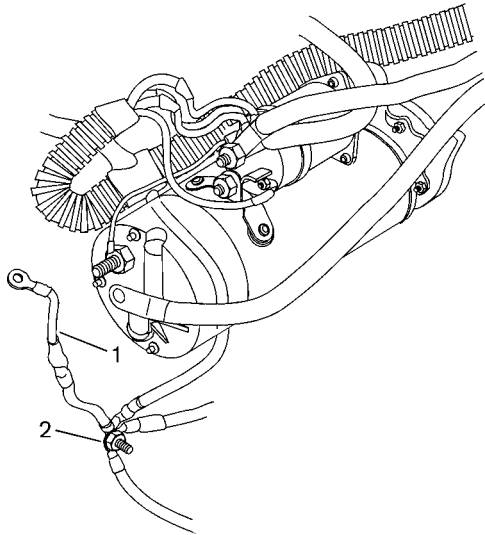
Turn the ignition key OFF and disconnect the negative and positive battery cables.



T8006862

3

Loosen the bolt on the battery cable clamping bracket. This will allow the negative battery cable to be removed.



W3002566

- 1 Fusible Link Removed
 - 2 Engine Ground Stud
- (Note: location varies by engine)

4

Remove the nut from the ground stud at the starter solenoid, and remove the fusible link terminal from the starter.

5

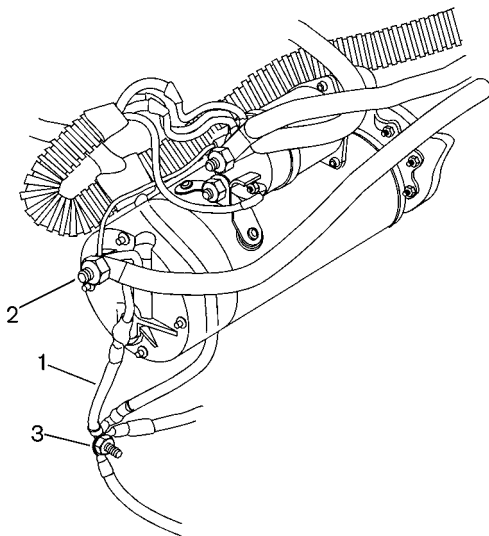
Remove the nut on the side of the engine block where the fusible link is connected, and remove the fusible link from the vehicle.

Installation

1

Install the fusible link terminal and negative battery cable at the starter ground stud. Install the nut and tighten to 30.5 ± 3.5 Nm (270 ± 30 in-lb).

30.5 ± 3.5 Nm (270 ± 30 in-lb)



W3002567

- 1 Ground Side Fusible Link
- 2 Starter Ground Stud
- 3 Engine Ground (location varies by engine)

2

Install the new fusible link cable assembly at the engine block. Tighten the nut to 19 ± 4 Nm (168 ± 35 in-lb).

19 ± 4 Nm
(168 ± 35 in-lb)

3

Install the battery cables into the clamping bracket. Tighten the bolt on the clamping bracket to 17 ± 3 Nm (150 ± 27 in-lb). Connect the battery cables into the clamp bracket. Tighten the bolt to 23 Nm (203 in-lb).

17 ± 3 Nm
(150 ± 27 in-lb)
, 23 Nm
(203 in-lb)

4

Connect the battery positive and negative cables, connecting the positive cable first. Torque nuts 24 ± 4 Nm (212 ± 35 in-lb).

3645-03-02-05 Central Door Lock Module, Replacement (Volvo Engines)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

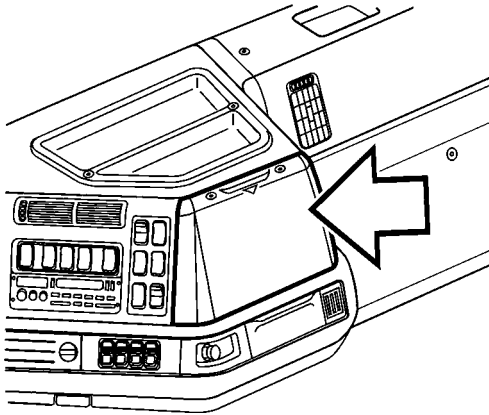
Removal

1

Turn the ignition key **OFF**.

2

Remove the two bolts attaching the front cover of the TEC, just above the ashtray. Remove the front cover to gain access to the central door lock module.



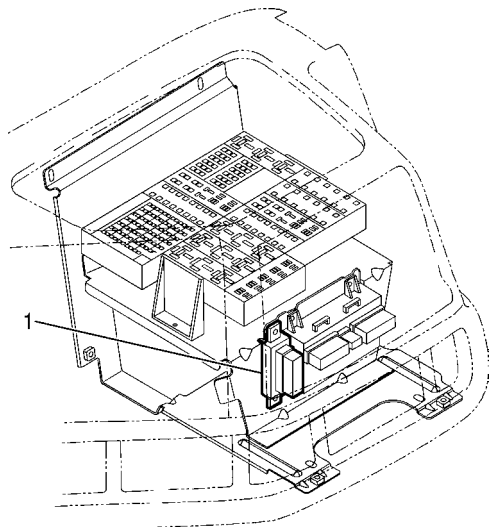
W3002701

3

Remove the ashtray from the ashtray housing. Remove the 2 screws from the ashtray housing, and remove the housing.

4

Clip the wire ties along the top of the Vehicle ECU to free the harness. Unplug the connector to the Central Door Lock Module. Remove the mounting screws, and remove the module.



W3002704

Installation

1

Install the new module in the same location where the old module was installed. Bolt the module in place with 2 torx bolts. Tighten to 4.0 ± 0.5 Nm (35 ± 4 in-lb).

4.0 ± 0.5 Nm
(35 ± 4 in-lb)

2

Reconnect the module electrical connector. Install wire ties to the VECU harness. Remove any excess wire tie.

3

Install the ashtray housing, using the two mounting screws. Tighten the screws to 1.5 ± 0.25 Nm (13.3 ± 2.2 in-lb). Install the ashtray.

1.5 ± 0.25 Nm
(13.3 ± 2.2 in-lb)

4

Install the front TEC cover. Tighten the bolts to 2.5 ± 0.5 Nm (22.1 ± 4.4 in-lb).

2.5 ± 0.5 Nm
(22.1 ± 4.4 in-lb)

3645-03-02-05

Central Door Lock Module, Replacement (Non-Volvo Engines)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

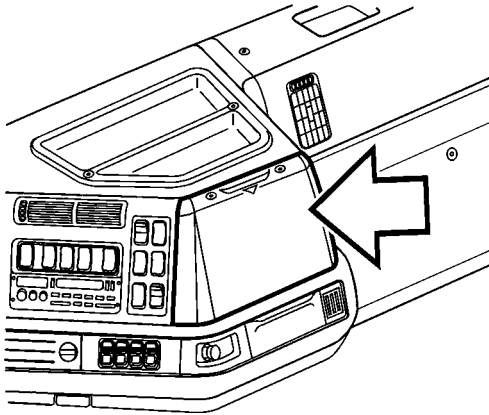
Removal

1

Turn the ignition key **OFF**.

2

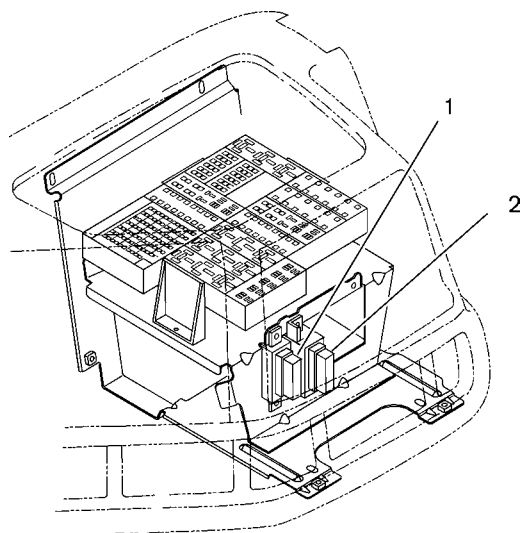
Remove the two bolts attaching the front cover of the TEC, just above the ashtray. Remove the front cover to gain access to both modules.



W3002701

3

Remove the ashtray from the ashtray housing. Remove the 2 screws from the ashtray housing, and remove the housing.



W3002524

- 1 Central Door Lock Module
- 2 Wiper Module

4

Disconnect the module connector, remove the mounting screws, and remove the module.

Installation

1

Install the new module in the same location where the old module was installed. Bolt the module in place with 2 torx bolts. Tighten to 4.0 ± 0.5 Nm (35 ± 4 in-lb). Connect the module electrical connector.

4.0 ± 0.5 Nm
(35 ± 4 in-lb)

2

Check the new module for correct operation of the system.

3

Install the ashtray housing, using the two mounting screws. Tighten the screws to 1.5 ± 0.25 Nm (13.3 ± 2.2 in-lb). Install the ashtray.

1.5 ± 0.25 Nm
(13.3 ± 2.2 in-lb)

4

Install the front TEC cover. Tighten the bolts to 2.5 ± 0.5 Nm (22.1 ± 4.4 in-lb).

2.5 ± 0.5 Nm
(22.1 ± 4.4 in-lb)

3341-03-02-01

Ignition Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

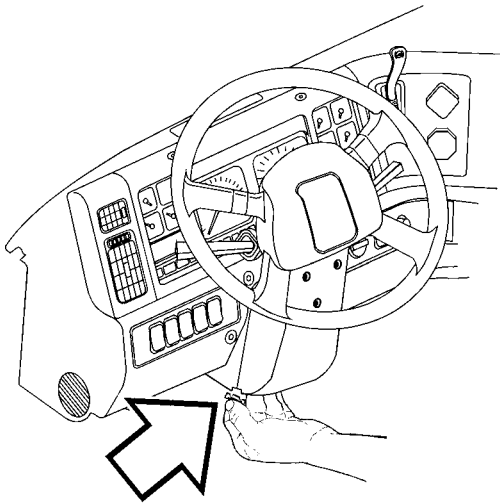
Removal from Locking Housing

1

Turn the ignition key **OFF**.

2

Remove the 2 clips at the bottom of the steering column cover.



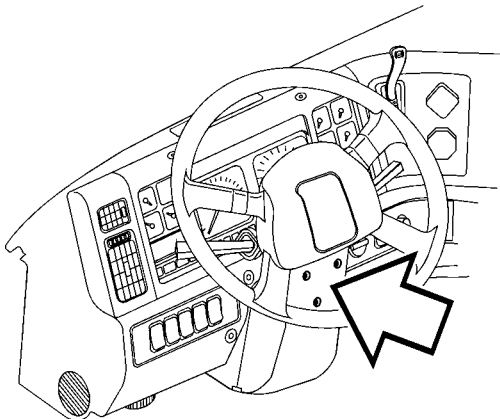
W8002166

3

Adjust the steering column up and toward you, where possible. Remove the front steering column cover by removing the 3 torx bolts from the cover and sliding the rubber grommets off of the cover at the stalk switches.

4

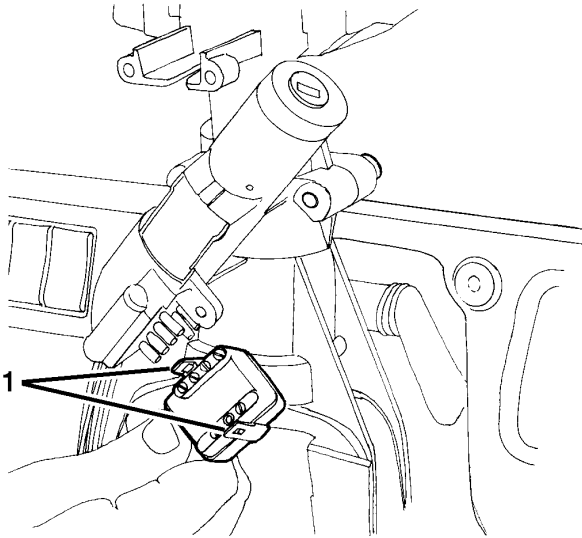
Adjust the steering column forward and up where possible. Remove the 3 torx bolts from the rear column cover and remove cover.



W8002165

5

Disconnect the ignition switch electrical connector by carefully depressing clips on each side of connector.

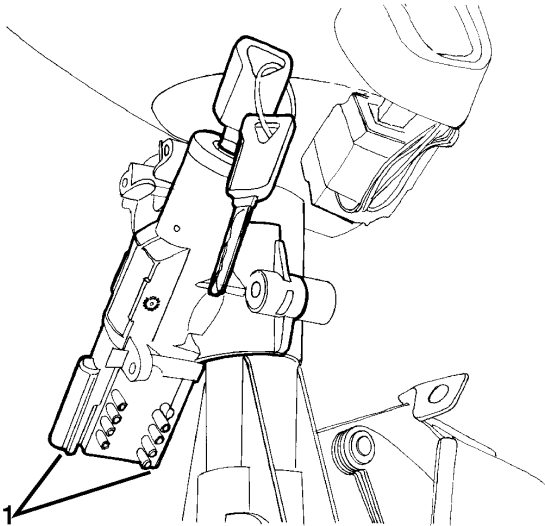


1 Locking Clips

W3001001

6

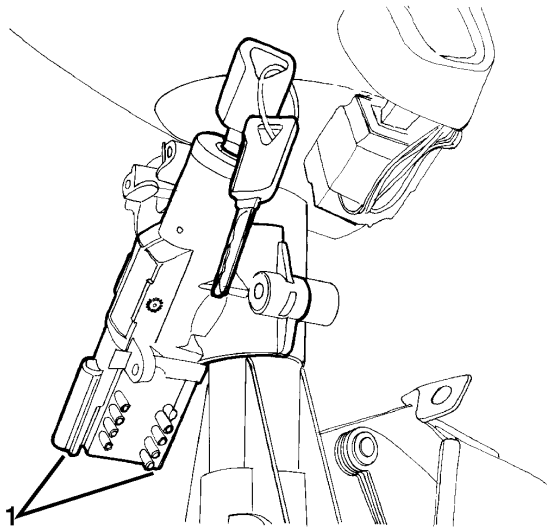
Remove the 2 machine screws on the left and right side of the ignition switch and remove the switch from its housing.



1 Machine Screws

W3000743

Installation into Locking Housing



1 Machine Screws

1

Place switch into locking housing, aligning slots on switch and housing shaft. Holding switch in place, start both screws before tightening. Tighten to 1.7 ± 0.5 Nm (15 ± 4 in-lb).

1.7 ± 0.5 Nm
(15 ± 4 in-lb)

2

Connect the ignition switch electrical connector.

3

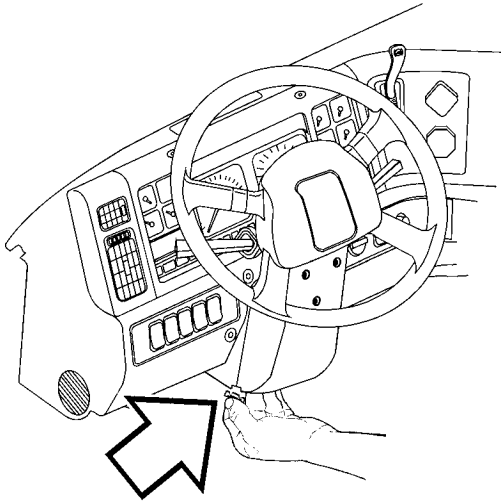
Pull steering column back and up, where possible. Install front cover by installing torx bolts. Tighten to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

4

Adjust the steering column forward and up, where possible. Install the rear cover of the steering column by installing torx bolts and attaching rubber grommets at the stalk switches. Tighten bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)



W8002166

5

Replace the 2 clips on the bottom of the steering column cover.

3341-03-02-02 Ignition Switch and Housing, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

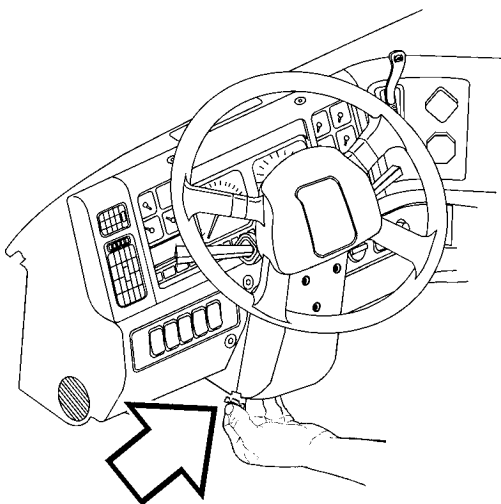
Removal

1

Turn the ignition key **OFF**.

2

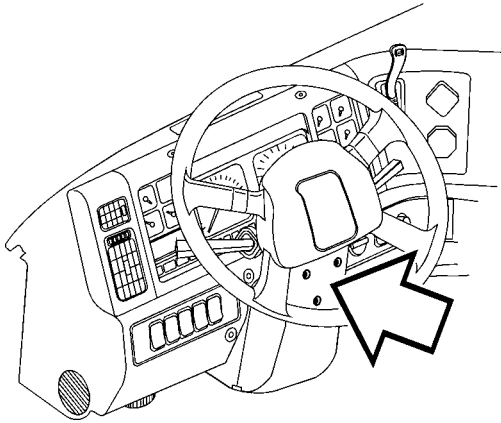
Remove the 2 clips at the bottom of the steering column cover.



W8002166

3

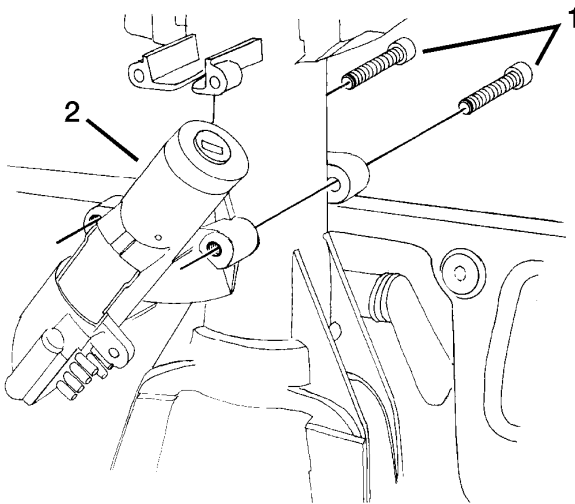
Adjust the steering column up and toward you, where possible. Remove the front steering column cover by removing the 3 torx bolts from the cover and sliding the rubber grommets off of the cover at the stalk switches.



W8002165

4

Adjust the steering column forward and up, where possible. Remove the 3 torx bolts from the rear column cover and remove cover.



W3000746

1 Bolts**2** Switch and Housing Assembly**5**

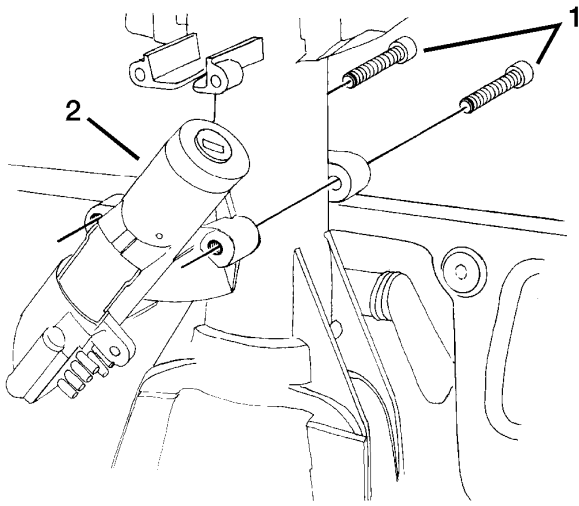
Disconnect the ignition switch electrical connector. Remove the 2 allen bolts from the forward side of the ignition switch housing to remove switch and housing.

Installation

1

Mount the switch and housing on the steering column with the 2 bolts. Tighten to 24 ± 4 Nm (18 ± 3 ft-lb).

24 ± 4 Nm
(18 ± 3 ft-lb)



W3000746

- 1 Bolts
- 2 Switch and Housing Assembly

2

Connect the ignition switch electrical connector.

3

Adjust the steering column forward and up, where possible. Install the rear cover of the steering column. Torque bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

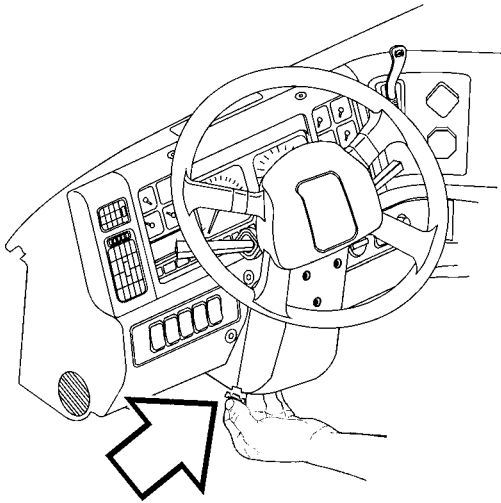
4

Adjust the steering column up and toward you, where possible. Install front cover by installing torx bolts and attaching rubber grommets at stalk switches. Tighten bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

5

Replace the 2 clips on the bottom of the steering column covers.



W8002166

3623-03-02-02

Air Horn Contact, Replacement

(without SRS)



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

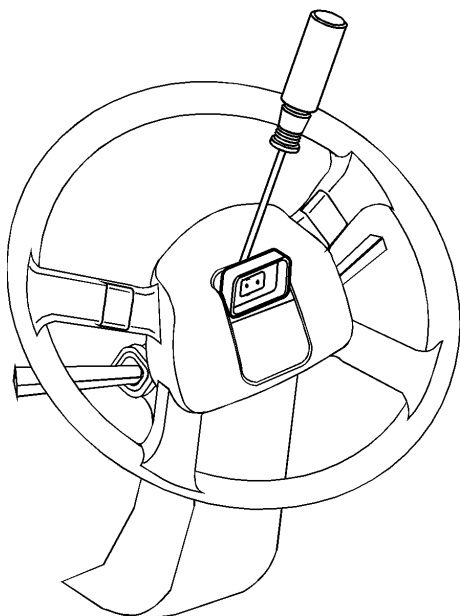
Removal, Air Horn Button and Horn Contact

1

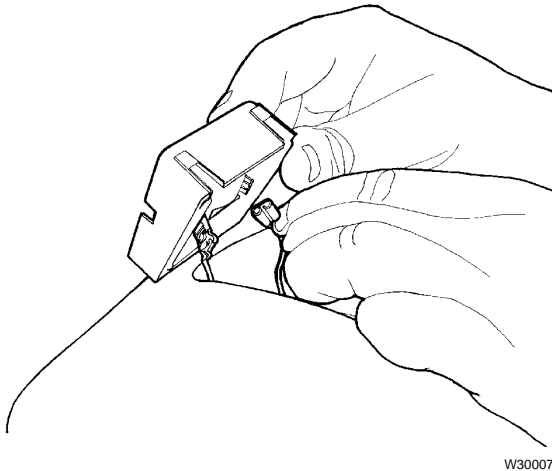
Turn the ignition key **OFF**.

2

Remove the horn button for the air horn (center of steering wheel) using a No. 1 flat tip screwdriver. Place the screwdriver between the horn button and steering wheel, and gently pry up on the button.



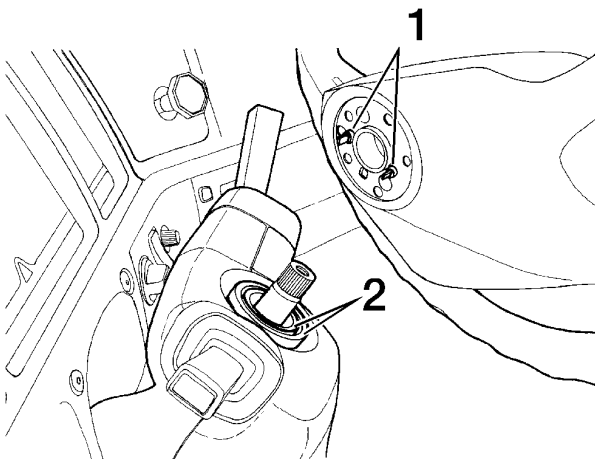
W3000789



W3000790

3

Remove the wire connectors from the underneath side of the button.



W3000791

- 1 Horn Contacts
- 2 Contact Assembly

4

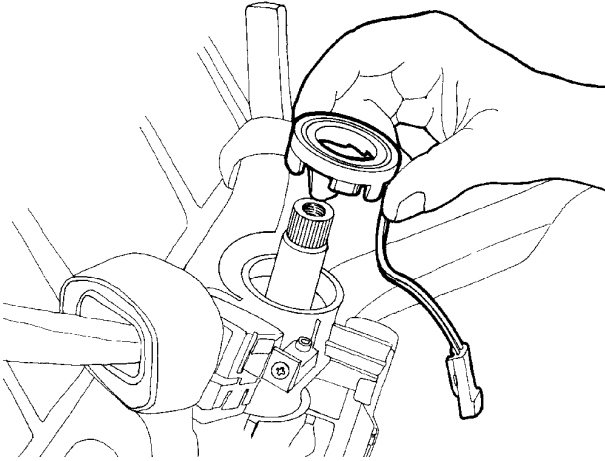
Remove the bolt from the steering wheel. Pull the steering wheel from the steering shaft.

5

Remove the 2 clips at the bottom of the steering column cover. Slide the rubber grommets off of the cover at the stalk switches.

6

Adjust the steering column up and toward you, where possible. Remove the 3 torx bolts from the rear column cover and remove cover.



W3000792

7

Disconnect the connector for the horn contact. Remove the contact assembly from the steering shaft.

8

Remove the contact in the steering wheel with a No. 1 flat tip screwdriver. Push the contact out from the horn button area.

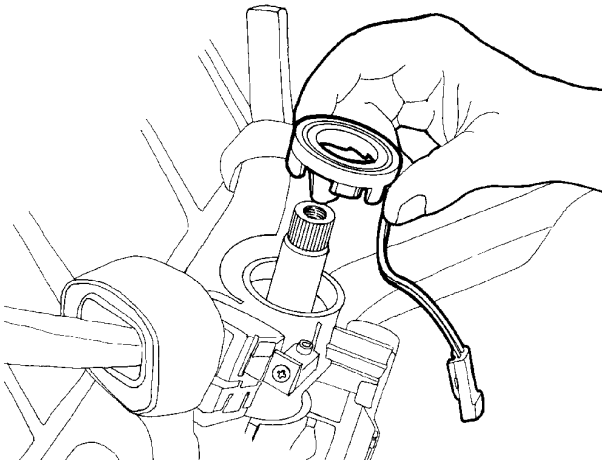
Installation

1

Insert the wire through the hole in the steering wheel where the old contact was. Align with the tab on the contact housing.

2

Install the horn contact ring onto the steering shaft. The ring should slide down over the shaft. Route the wires as they originally were and connect the electrical connector.



W3000792

3

Adjust the steering shaft forward and up, where possible. Install the rear cover of the steering column. Tighten the 3 bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

4

Install the 2 clips on the bottom of the steering column covers, and slide the rubber grommets onto the stalk switches.

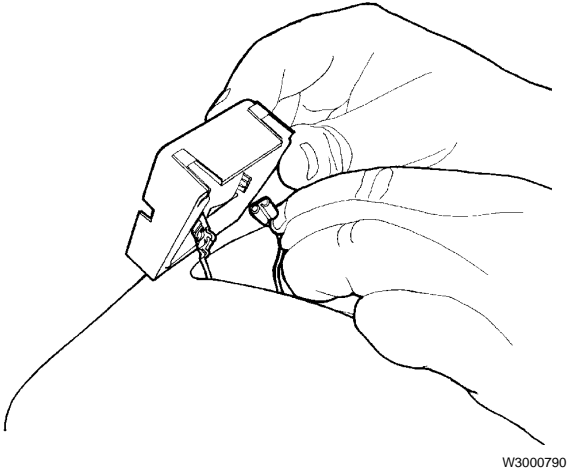
5

Install the steering wheel onto the shaft, lining up the marks. Install a new bolt and tighten to 85 Nm (62.7 ft-lb).

85 Nm
(62.7 ft-lb)

6

Install the air horn button by connecting wire connectors and pushing the button into the steering wheel.



3623-03-02-04

City Horn Contact, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

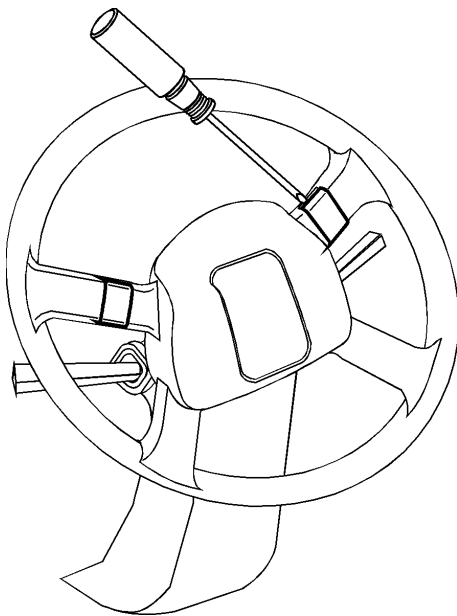
Removal

1

Turn the ignition key **OFF**.

2

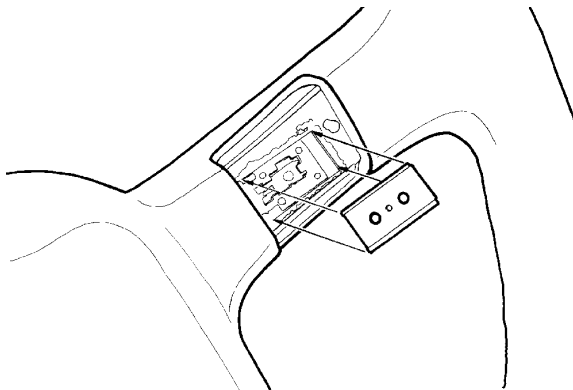
Remove the city horn buttons by inserting a small, flat tip screwdriver (No. 1) under each of the 2 horn buttons as shown. Gently pry up on the button and remove.



W3000782

3

Remove the contact strip under the button.

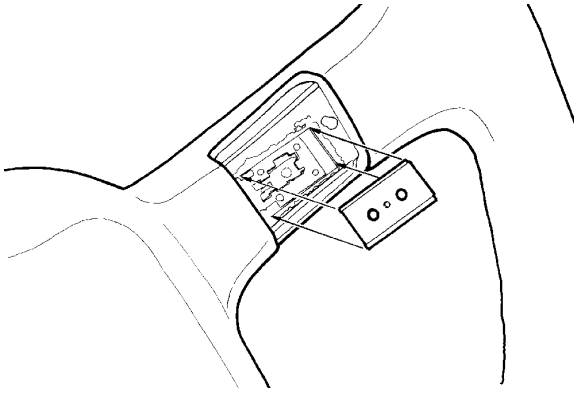


W3000793

Installation

1

Install the city horn buttons by first installing the contact strip. Then insert the button toward the inside of the steering wheel, making certain the dowel is aligned with the hole in the steering wheel. Push the button into place.



W3000793

3621-03-02-03

City Horn, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Note: The city horn is generally located on the left side in front of the radiator on the VHD, and inside the left front frame rail on the VN.

1

Turn the ignition key **OFF**.

2

Disconnect the electrical connector.

3

Remove the mounting nut securing the horn to the bracket. Remove the horn from the vehicle.

4

Position the replacement horn in the mounting bracket. Secure with the mounting nut.

5

Connect the electrical connector and check horn operation.

3621-03-02-02

Air Horn Solenoid, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Note: The air horn solenoid may be located inside the right front frame rail near the radiator or inside the left frame rail near the drivers seat.

1

Turn the ignition key **OFF**.

2

Disconnect the electrical connector.

3

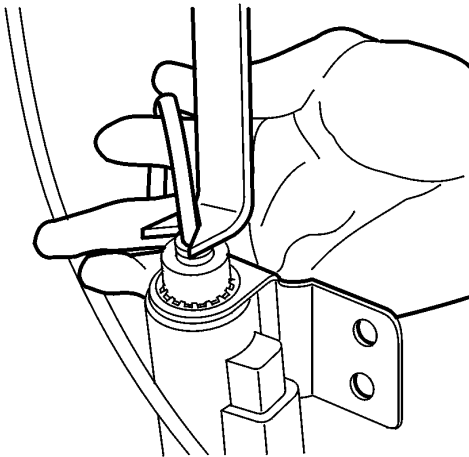


WARNING

Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Bleed all air from the vehicle air brake system. Use tool J-42189 to remove the two air lines from the solenoid.

Note: It may be easier to remove the solenoid from its mounting location before removing the air lines.



W0001908

4

Remove the mounting bolts and remove the solenoid from the vehicle.

5

Position the replacement solenoid in its mounting location and secure with mounting bolts.

6

Connect the air lines and electrical connector. Check horn operation.

3643-03-02-01

Turn Signal/CC Switch Assembly, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

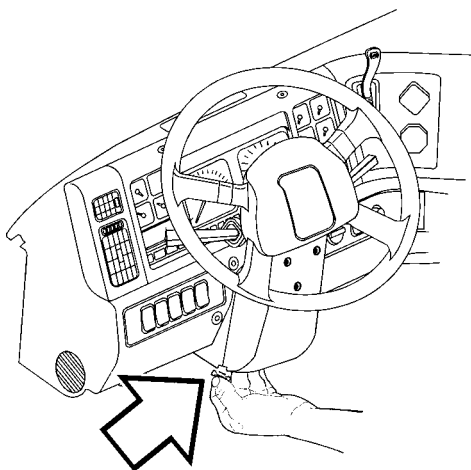
Removal

1

Turn the ignition key **OFF**.

2

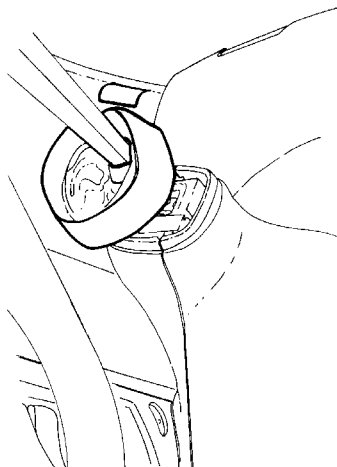
Remove the 2 clips at the bottom of the steering column cover.



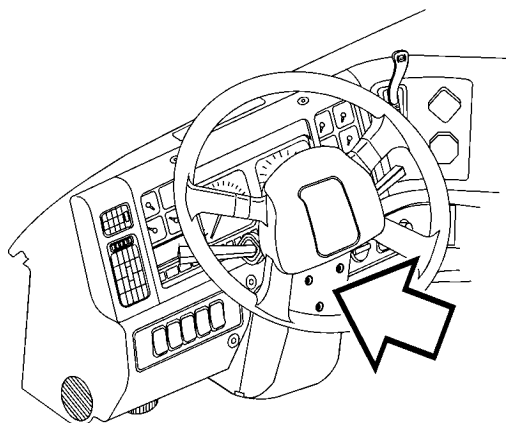
W8002166

3

Adjust the steering column up and toward you, where possible. Remove the front steering column cover by removing the 3 torx bolts from the cover and sliding the rubber grommets off of the cover.



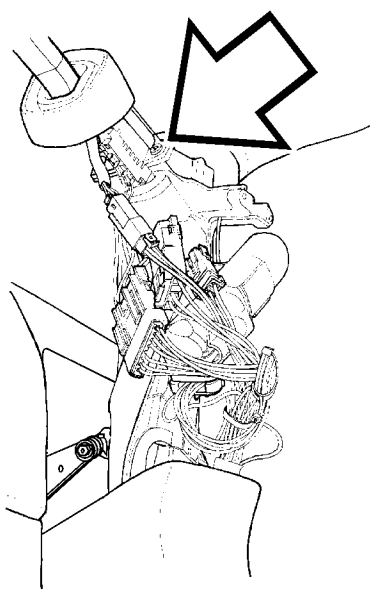
W3000653



W8002165

4

Push the steering column forward and up, where possible. Remove the 3 torx bolts from the rear column cover and remove cover.



W3000643

5

Disconnect all electrical connections for turn signals, cruise, and headlamp dimmer switch. Remove the 2 torx bolts on the sides of the switch and remove switch.

Installation

1

Mount the switch assembly to steering column with the 2 bolts and connect all electrical connectors. Tighten bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

2

Pull steering column back and up, where possible. Install front cover by installing torx bolts. Tighten bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

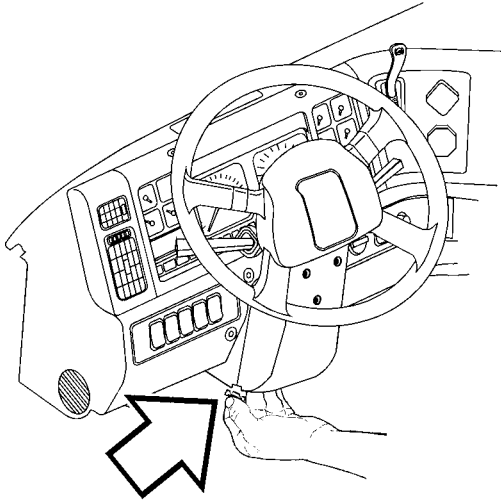
3

Push the steering column forward and up, where possible. Install the rear cover of the steering column by installing torx bolts and attaching rubber grommets at the stalk switches. Tighten bolts to 5 ± 0.8 Nm (44 ± 7 in-lb).

5 ± 0.8 Nm
(44 ± 7 in-lb)

4

Install the 2 clips on the bottom of the steering column cover.



W8002166

3646-03-02-11**Hazard Warning Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-33**Back of Cab Lamp Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-34**Fan Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-35**PTO Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-36**Bunk Overhead Lamp Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-37**Headlamp Interrupt Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-38**Snowplow Lamp Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

3646-03-02-39**Smoke Detector Disable Switch, Replacement**

For a complete description of this procedure, see "Switch, Replacement (Left Dash Switches)" page 115.

Switch, Replacement (Left Dash Switches)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

1

Turn the ignition key **OFF**.

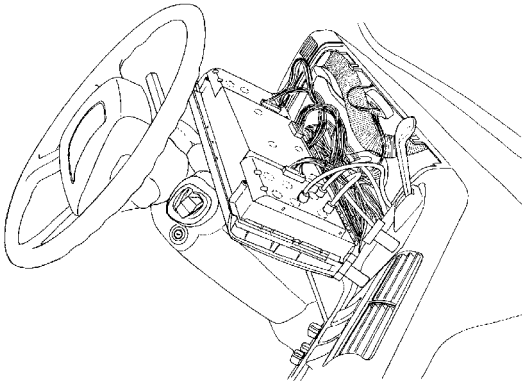
2



CAUTION

Do not leave the cluster face-down for more than 15 minutes, or damage to the gauges may occur. Gauge oil can run out the front of the gauge faces and make the gauges inaccurate.

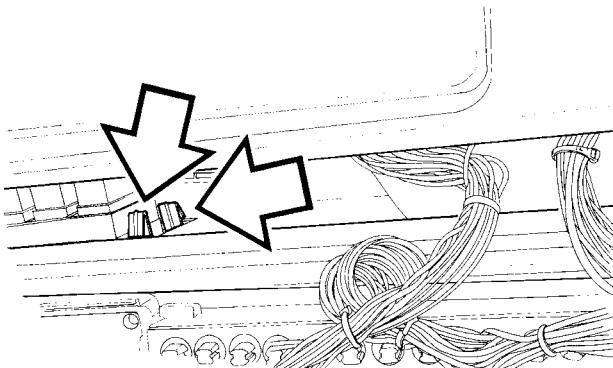
Remove the two screws at the top of the instrument cluster and lay the cluster face-down on the steering column (adjust steering column back before leaning cluster out, where possible).



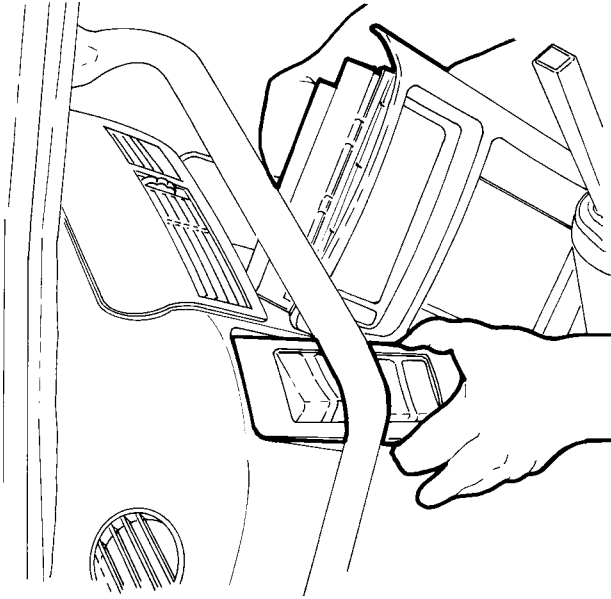
W3000641

3

To release the switch panel, reach behind the panel and depress the top and bottom clips on the right and left side of the panel.



W3000689



W3000660

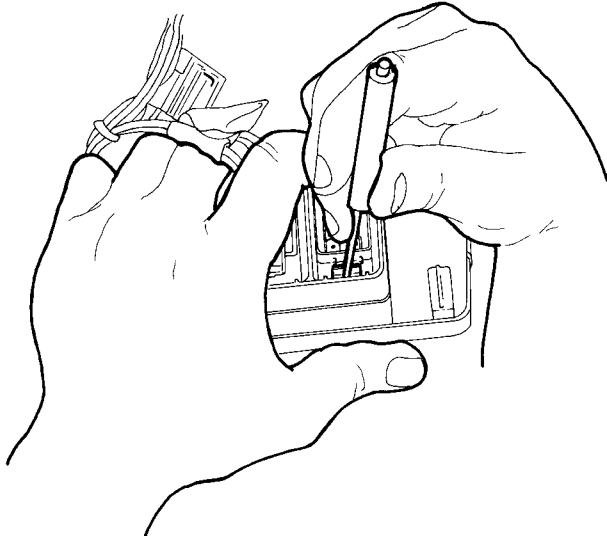
4

Pull the panel through the front of the dash.

5

Once the panel is removed, install the instrument cluster in the dash and tighten the 2 screws at the top of the cluster. Tighten to 2 ± 0.3 Nm (17.5 ± 2.5 in-lb).

2 ± 0.3 Nm (17.5 ± 2.5 in-lb)



W3000659

6

Disconnect the electrical connector from the switch to be removed. Insert a small flat tip screwdriver (No. 1) into the bottom of the switch to release the locking tab, then remove the switch from the panel (these switches are removed through the front of the panel).

Installation

1

Install the new switch, pushing the switch into the panel until it locks. Push back on the switch to make certain it is locked in the panel. Connect electrical connector and install panel back in dash.

3646-03-02-29**Sleeper Control Panel Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-22**Auxiliary Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-24**Marker Interrupt Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-40**Engine/Exhaust Brake Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-41**Traction Control Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-26**Heated Mirror Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-42**Lift Axle Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

3646-03-02-43**Beacon Lamp Switch, Replacement**

For a complete description of this procedure, see
"Right Dash/Auxiliary/Sleeper Control Panel Switch,
Replacement" page 119.

Right Dash/Auxiliary/Sleeper Control Panel Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

The same procedure is used to replace both right dash, optional (auxiliary) and sleeper control panel switches. The right dash switches may include Marker Interrupt, Engine Brake, Traction Control, or Heated Mirror Switches. Optional or auxiliary switches are used for additional customer requested components, such as lift axle or beacon lights, and are located in the panel above the radio.

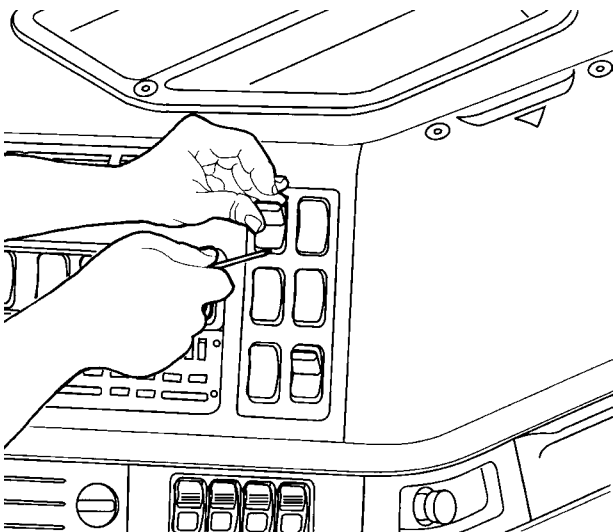
Removal

1

Turn the ignition key **OFF**.

2

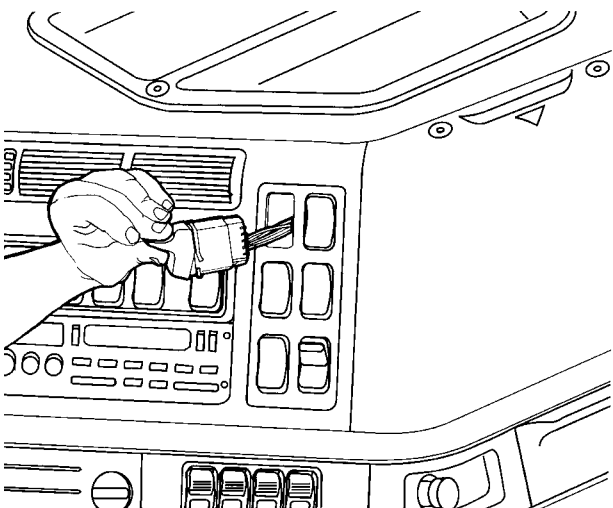
Insert a No. 1 flat tip screwdriver into the bottom of the switch to release the locking tab.



W3000644

3

The switch will rock out at the bottom. Pull the switch down from the top and out.



W3000645

4

Disconnect the electrical connector of the switch being removed.

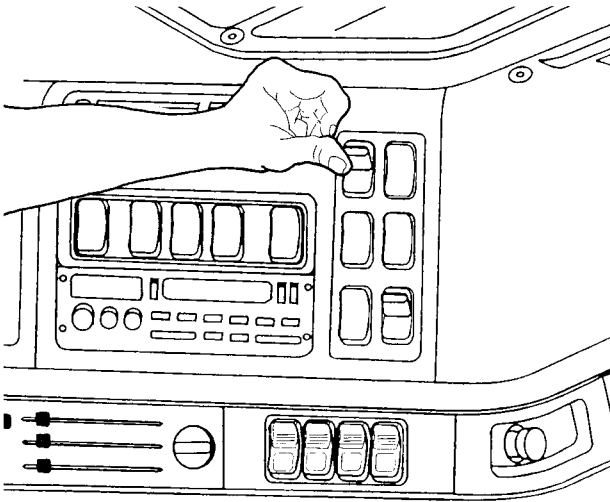
Installation

1

Connect electrical connection on switch.

2

Install the new switch, pushing the switch into the panel until it locks. Push back on the switch to make certain it is locked in the panel.



W3000692

3646-03-02-32 Pneumatic Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

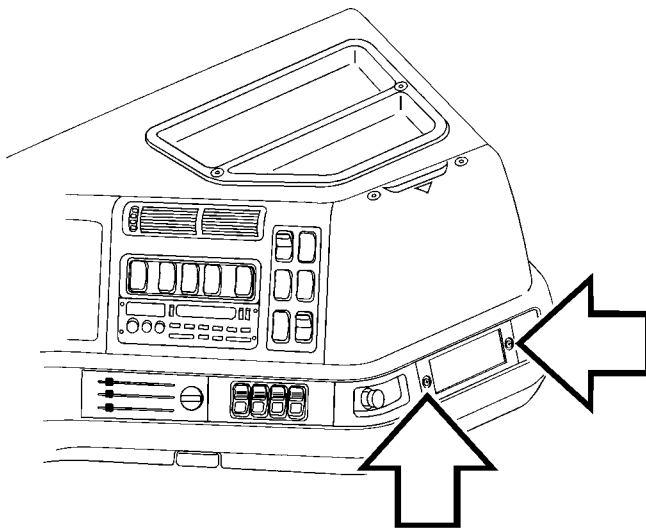
Removal

1

Turn the ignition key **OFF**.

2

Remove the ashtray from the ashtray housing. Remove the 2 screws from the ashtray housing, and remove the housing.



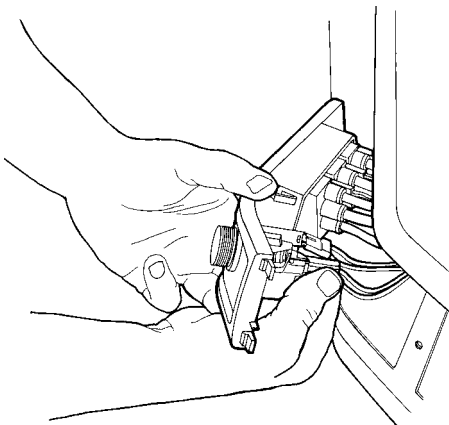
W3000649

3

Once the ashtray housing is removed, the air switch panel can be removed from the dash. Pull the air switch panel away from the dash and to the left to clear the tip inserts.

4

Disconnect the 2 terminal connectors from the cigar lighter and the electrical LED connections on the switch being replaced.



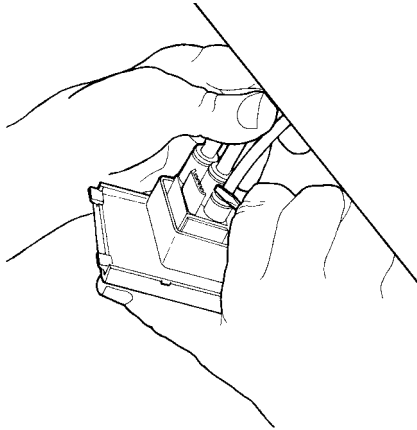
W3000656

5

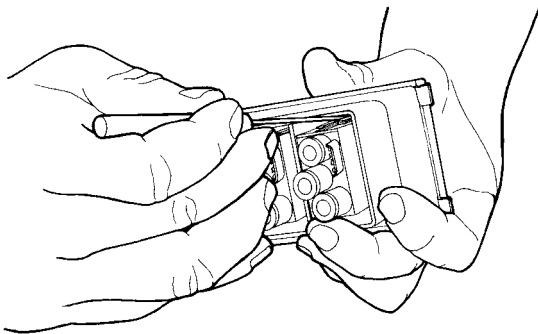
**WARNING**

Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Drain air pressure from vehicle system. Mark each air line to keep correct arrangement. Disconnect air lines at switch being replaced by pushing in on the ring and air line, then pulling the air line out.



W3000657



W3000658

6

To remove switch, insert No. 1 flat tip screwdriver into back of switch at top and bottom to release locking tabs. Push switch out of the panel.

Installation

1

Install new air switch into the panel, pushing the switch into the panel until it locks. Push back on the switch to make certain it is locked in the panel.

2

Connect air lines to the switch, making sure they are installed in the correct position. Be sure to insert airline to line indicated.

3

Connect electrical LED connections on switch, and both cigar lighter connectors.

4

Align and install switch panel in dash.

5Install ashtray housing with the 2 mounting screws, and place ashtray in housing. Tighten screws to 0.4 ± 0.1 Nm (3.5 ± 1 in-lb). 0.4 ± 0.1 Nm
(3.5 ± 1 in-lb)

3646-03-02-06 Headlamp/Parking Lamp Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

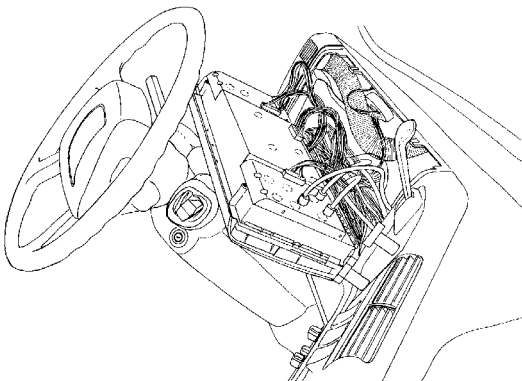
Removal

1Turn the ignition key **OFF**.**2**

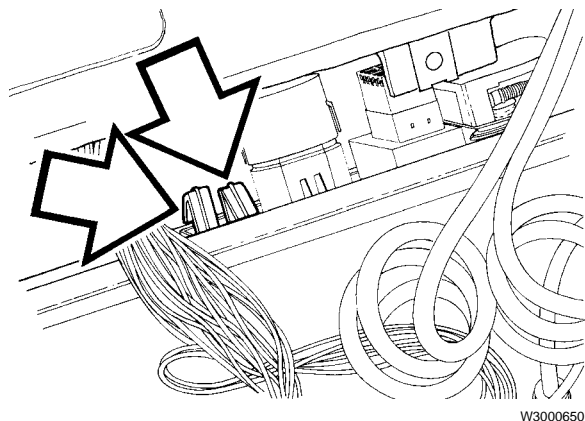
CAUTION

Do not leave the cluster face-down for more than 15 minutes, or damage to the gauges may occur. Gauge oil can run out the front of the gauge faces and make the gauges inaccurate.

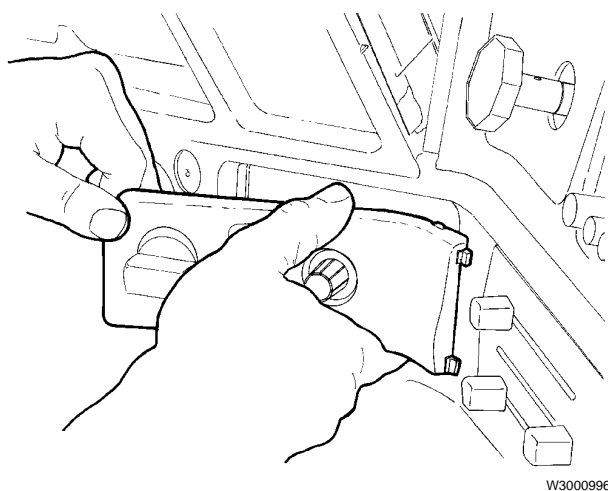
Remove the two screws at the top of the instrument cluster and lay the cluster face-down on the steering column (if steering column is adjustable, adjust as far back as possible before leaning the cluster out).



W3000641

**3**

To release the switch panel, reach behind the panel and depress the top and bottom clips on the left side.

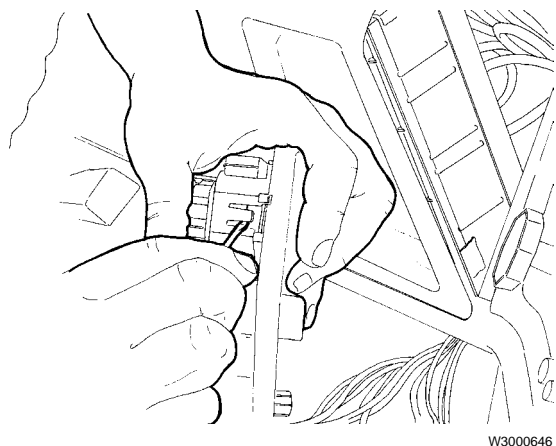
**4**

Pull the panel through the front of the dash, pulling toward the driver's side to clear tip inserts.

5

Once the switch panel is removed, install the instrument cluster in the dash and tighten the 2 screws at the top of the cluster. Tighten to 2 ± 0.3 Nm (17.5 ± 2.5 in-lb).

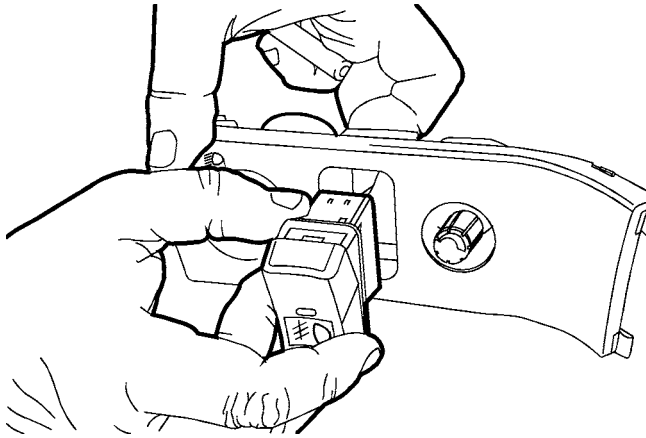
2 ± 0.3 Nm
(17.5 ± 2.5 in-lb)

**6**

Disconnect connector. Remove switch from panel by pulling locking tabs away from switch with a No. 1 screwdriver.

7

Remove the switch through the front of the panel.

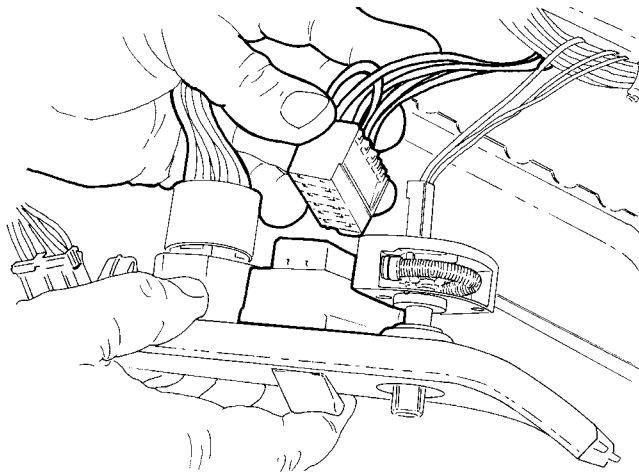


W3000682

Installation

1

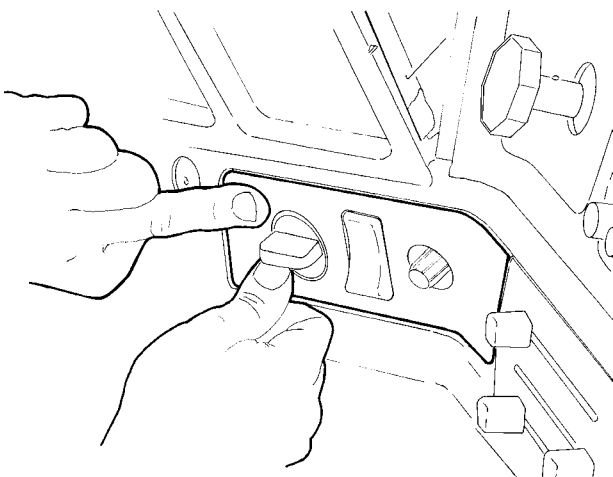
Install the new switch into the panel. Push the switch into the panel until it locks. Push back on the switch to make certain it is locked in the panel. Connect the electrical connector.



W3000680

2

Install the panel by inserting tips on right side and pushing the panel into position. The clips will snap in place on the left side.



W3000647

3646-03-02-23

Fog/Driving Lamp Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

1

Turn the ignition key **OFF**.

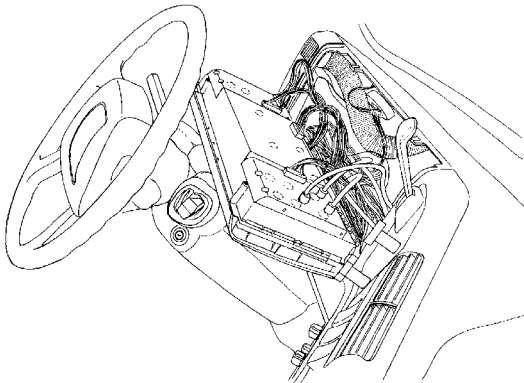
2



CAUTION

Do not leave the cluster face-down for more than 15 minutes, or damage to the gauges may occur. Gauge oil can run out the front of the gauge faces and make the gauges inaccurate.

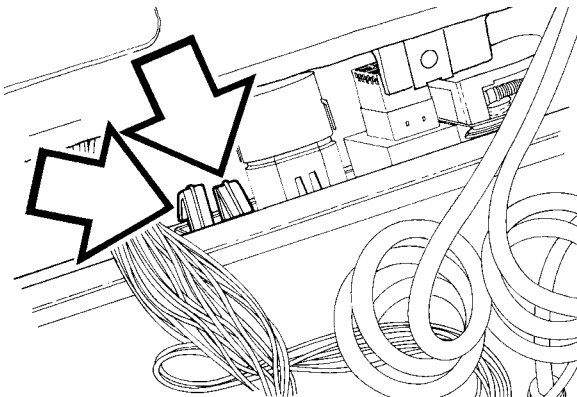
Remove the two screws at the top of the instrument cluster and lay the cluster face-down on the steering column (if steering column is adjustable, adjust as far back as possible before leaning the cluster out).



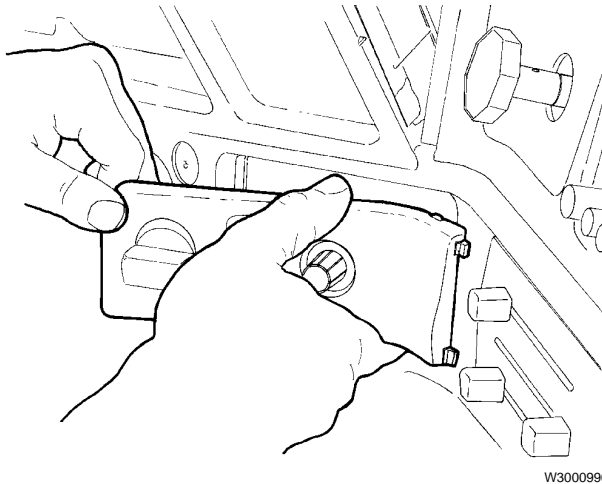
W3000641

3

To release the switch panel, reach behind the panel and depress the top and bottom clips on the left side.



W3000650



W3000996

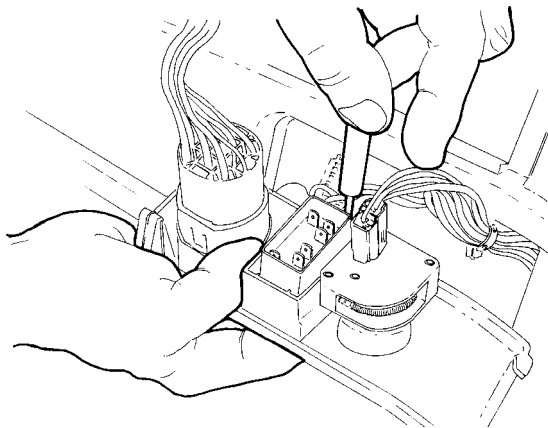
4

Pull the panel through the front of the dash, pulling toward the driver's side to clear tip inserts.

5

Once the switch panel is removed, install the instrument cluster in the dash and tighten the 2 screws at the top of the cluster. Tighten to 2 ± 0.3 Nm (17.5 ± 2.5 in-lb).

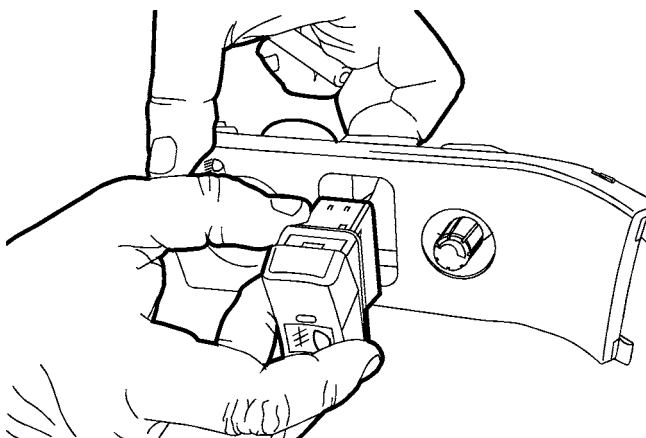
2 ± 0.3 Nm
(17.5 ± 2.5 in-lb)



W3000679

6

Disconnect connector. Remove switch from panel by inserting a No. 1 screwdriver into the back of the switch at the top and bottom to release the locking tabs.



W3000682

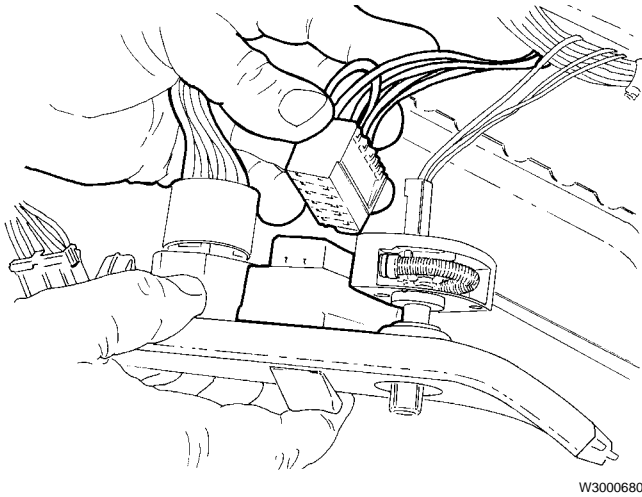
7

Remove the switch through the front of the panel.

Installation

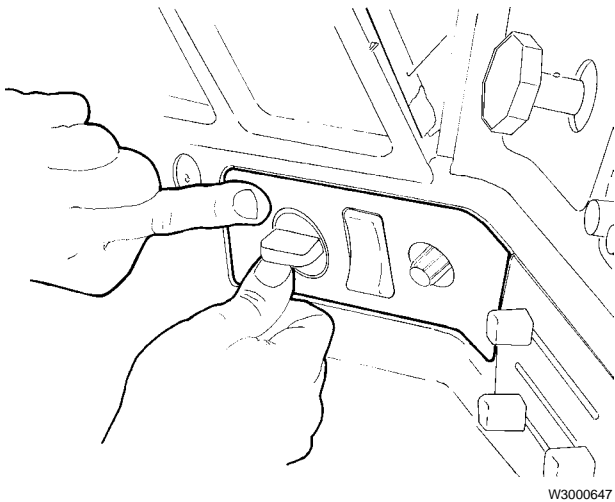
1

Install the new switch into the panel. Push the switch into the panel until it locks. Push back on the switch to make certain it is locked in the panel. Connect the electrical connector.



2

Install the panel by inserting tips on right side and pushing the panel into position. The clips will snap in place on the left side.



3646-03-02-12

Dash Dimmer Control Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

1

Turn the ignition key **OFF**.

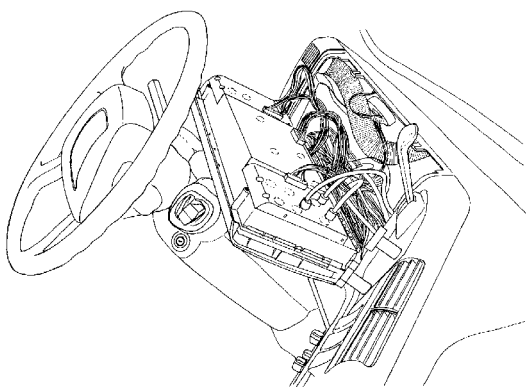
2



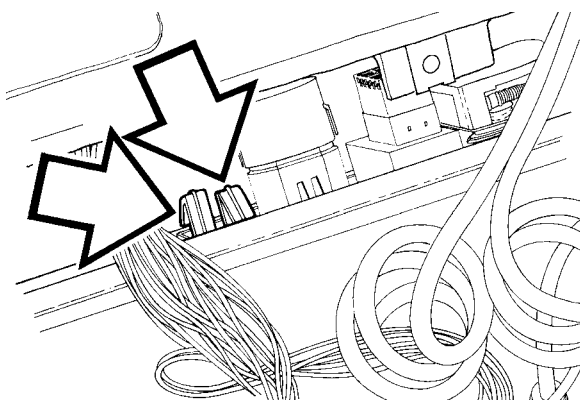
CAUTION

Do not leave the cluster face-down for more than 15 minutes, or damage to the gauges may occur. Gauge oil can run out the front of the gauge faces and make the gauges inaccurate.

Remove the two screws at the top of the instrument cluster and lay the cluster face-down on the steering column (if steering column is adjustable, adjust as far back as possible before leaning cluster out).



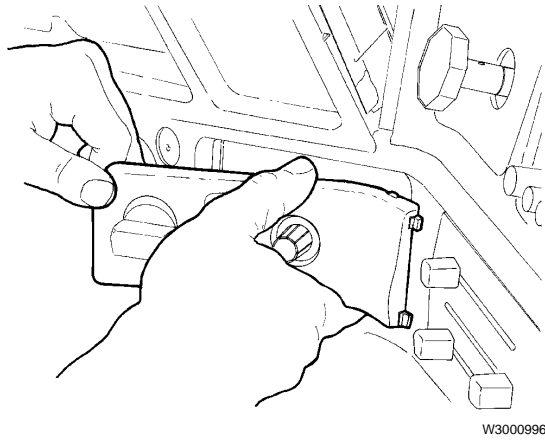
W3000641



W3000650

3

To release the dimmer switch panel, reach behind the panel and depress the top and bottom clips on the left side.



W3000996

4

Pull the panel through the front of the dash, pulling toward the driver's side to clear tip inserts.

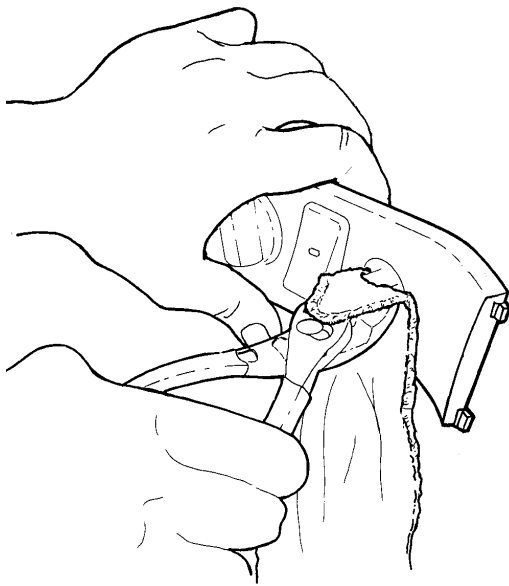
5

Once the panel is removed, install instrument cluster back in its original position and tighten the 2 screws at the top of the cluster. Tighten to 2 ± 0.3 Nm (17.5 ± 2.5 in-lb).

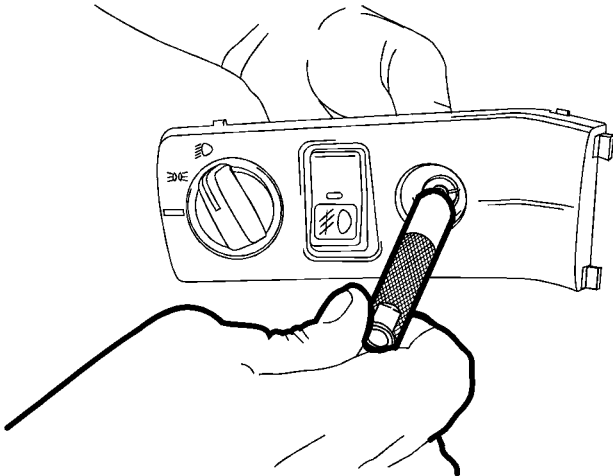
2 ± 0.3 Nm
(17.5 ± 2.5 in-lb)

6

Use a rag and a pair of pliers to remove the rheostat knob. Then disconnect the terminal connectors on the switch.



W3000812



W3000798

7

Use the rheostat removal tool (J-42395) to remove the shaft nut from the rheostat.

J-42395

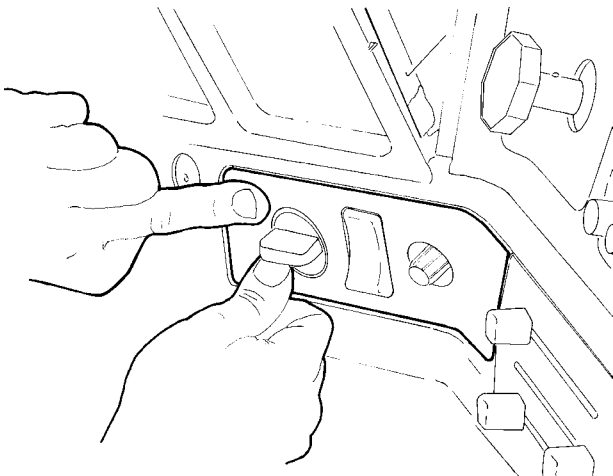
Installation

1

Install the new rheostat into panel. Install the nut on the rheostat shaft. Connect the terminal connectors and install the knob.

2

Install panel by inserting tips on right side and pushing the panel into position. The clips will snap in place on the left side.



W3000647

3647-03-02-01 Cigar Lighter, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

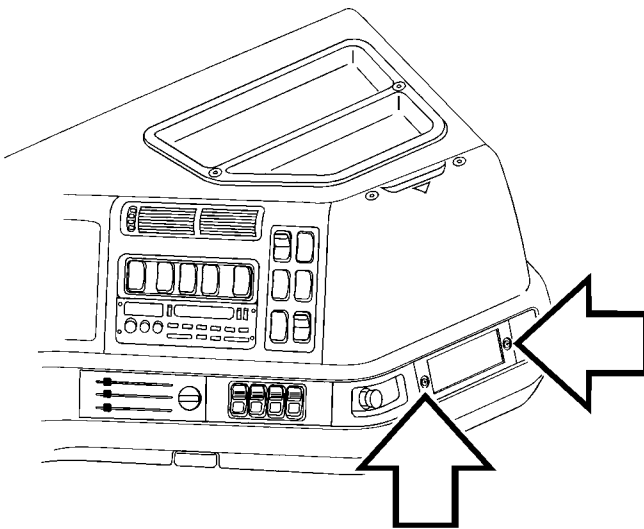
Removal

1

Turn the ignition key **OFF**.

2

Remove the ashtray from the ashtray housing. Remove the 2 screws from the ashtray housing, and remove the housing.



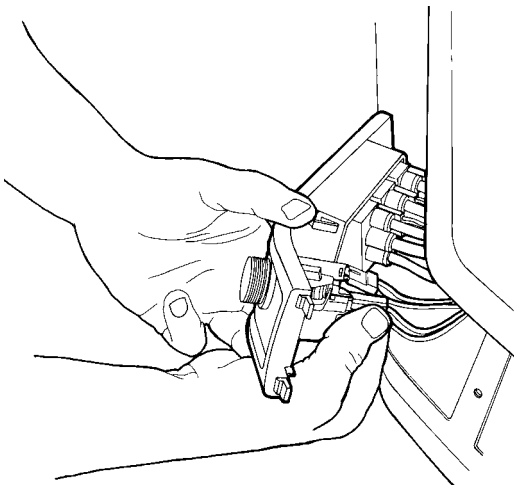
W3000649

3

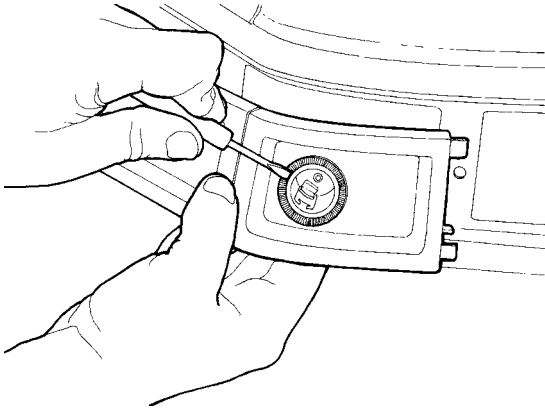
Once the ashtray housing is removed, the air switch panel can be removed from the dash. Pull the air switch panel away from the dash and to the left to clear the tip inserts.

4

Disconnect the 2 terminal connectors at the cigar lighter.



W3000656



W3000696

5

Push the lighter housing out of the panel enough to get a small flat tip screwdriver under the lip of the cigar lighter. Remove the lighter from the LED housing, and slide the housing out of the dash.

Installation**1**

Install the LED housing back into the dash panel. Make sure it's properly aligned with the molding. Push the cigar lighter through the LED housing until it touches the LED. Connect the terminal connectors.

2

Install the panel back into the dash. Install the ashtry housing with 2 torx screws and install the ashtray.

3646-03-02-28

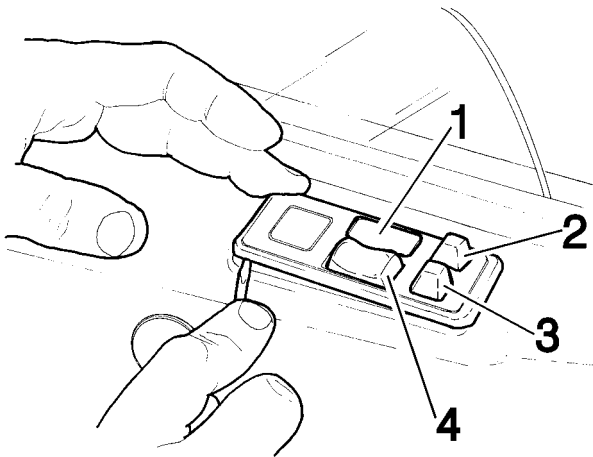
Window/Power Mirror Switch, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

1

Insert a No. 1 screwdriver into the corner of the switch panel to remove it from the door panel.

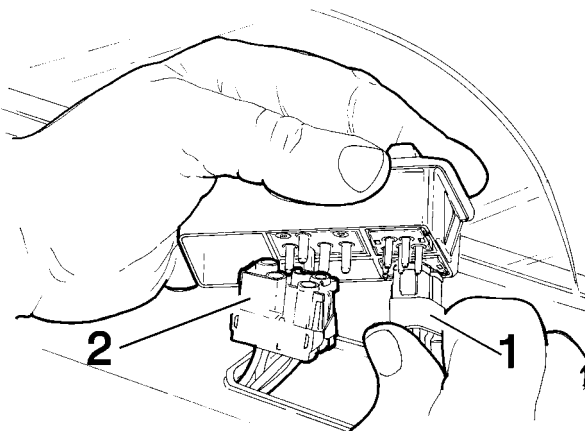


W3000806

- 1 Location for Driver's Side Window Switch (shown not installed)
- 2 Driver Side Mirror Switch
- 3 Passenger Side Mirror Switch
- 4 Passenger Side Window Switch

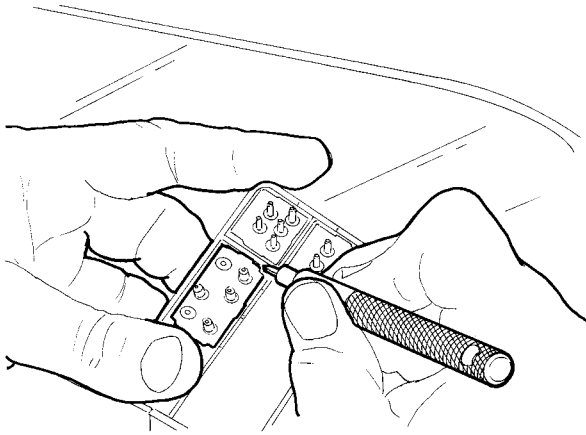
2

Disconnect all the mirror and window switches installed in the panel. Mark the wire connectors to keep the arrangement correct.



W3000805

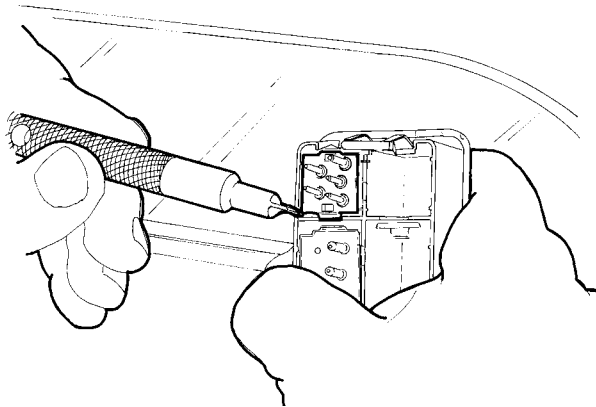
- 1 Mirror Switch Connector
- 2 Window Switch Connector



W3000802

3

For the window switch, insert the mirror/window switch removal tool between the housing clip and the window switch. When the tool is inserted, push on the switch to clear the switch tabs from the clips. Repeat on the opposite end and push the switch out.



W3000803

4

For the mirror switch, insert the mirror/window switch removal tool between the inner housing lip and the mirror switch. When the tool is inserted, push on the switch to clear the locking tab. Then insert the removal tool between the outer lip and the mirror switch. Keeping a steady pressure, push the switch out of the housing.

Installation

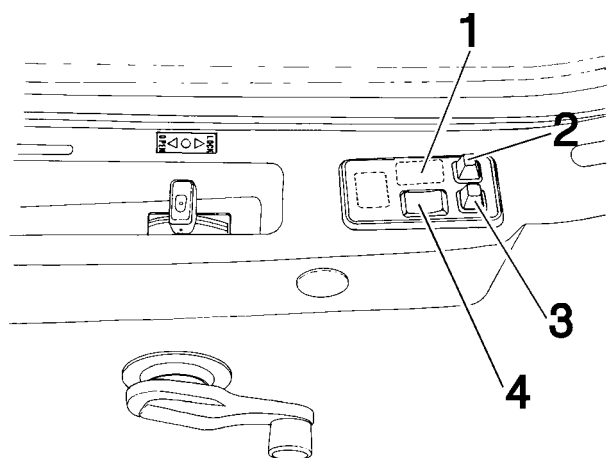
1

For the window switch, the tabs are different sizes on each end, so make certain the switch is aligned the correct way and push the switch into the housing.

For the mirror switch, align the tip of the housing with the indentation in the switch. The switch will push into the housing.

2

Make certain the replaced switch is locked into the panel. Connect the switch connectors and install the assembly into the door panel.



W3000804

Switches on driver's side door

- 1 Location for Driver's Side Window Switch
(shown not installed)
- 2 Driver Side Mirror Switch
- 3 Passenger Side Mirror Switch
- 4 Passenger Side Window Switch

3838-03-02-02

Digital Clock, Replacement (Sleeper)

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

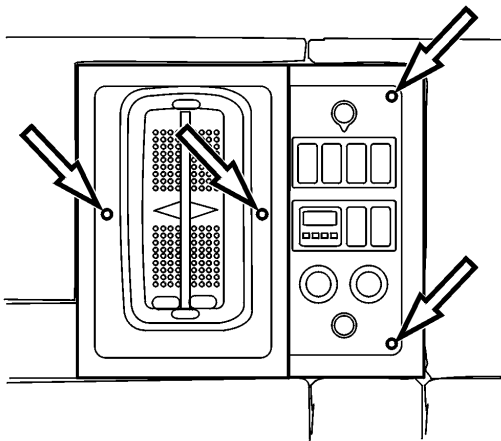
Removal

1

Turn the ignition key **OFF**.

2

VN420, 610 660: Remove the screws from the sleeper control panel and bezel. Remove the panel and bezel. VN770: Remove the screws from the sleeper control panel and remove.

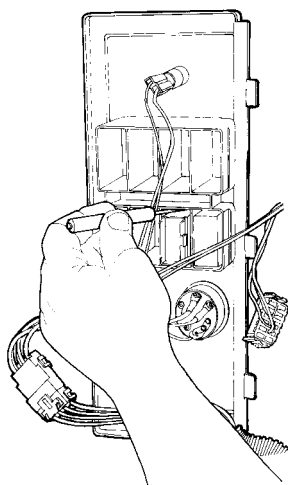


W8002730

VN420, 610, 660 Sleeper Control Panel

3

Disconnect the clock electrical connector. Using a small flat tip screwdriver, release the locking tabs at the top and bottom of the clock to remove the clock from the panel. The clock will push out through the front of the panel.

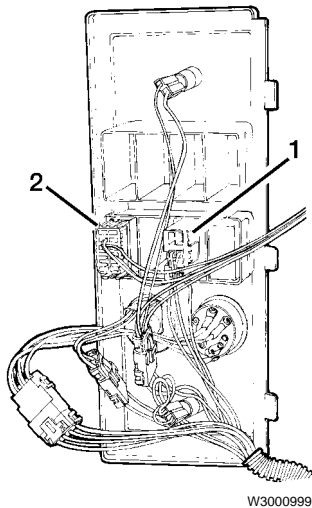


W3000698

Installation

1

Install the new clock assembly (1) into the control panel and connect the electrical connector. Gently pull on the clock to make certain it is locked in the panel.

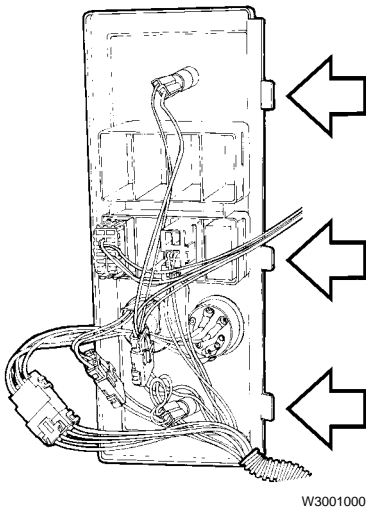


- 1 Clock
- 2 Switch

2

VN 420, 610, 660: Loosely install the control panel and vent bezel. The right side panel tabs must fit into the bezel slots. Secure with screws.

VN770: Install the sleeper control panel and secure with screws.



VN 420 /610 /660 Panel Tabs

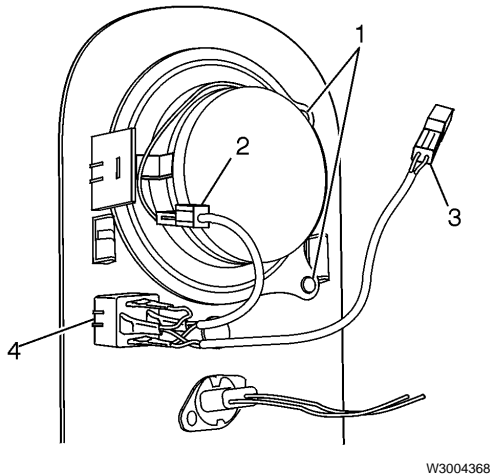
3935-03-02-01

TV Speaker/Headphone Jack, Replacement

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Removal

- 1**
Turn the ignition key **OFF**. Turn off the power to the TV.
- 2**
Remove the six screws from the sleeper control panel. Pull the panel cover away from the bunk wall.
- 3**
Disconnect the TV speaker and harness connector.



Sleeper Control Panel, Rear View

- 1 Speaker Mounting Screws
- 2 TV Speaker Connector
- 3 TV Harness Connector
- 4 TV Jack

- 4**
Remove the two mounting screws for the TV speaker. Remove the TV speaker.
- 5**
To remove the TV speaker jack, remove the nut on the front with a 1/2 inch socket and remove the jack.

Installation

- 1**
Install the replacement TV speaker into the control panel with the two mounting screws.

2

Install the replacement speaker jack and secure the nut with a 1/2 inch socket.

3

Connect the connectors.

4

Turn on power to the TV. Check the speaker for operation.

5

Insert the sleeper control panel into the trim panel. Install the six mounting screws.

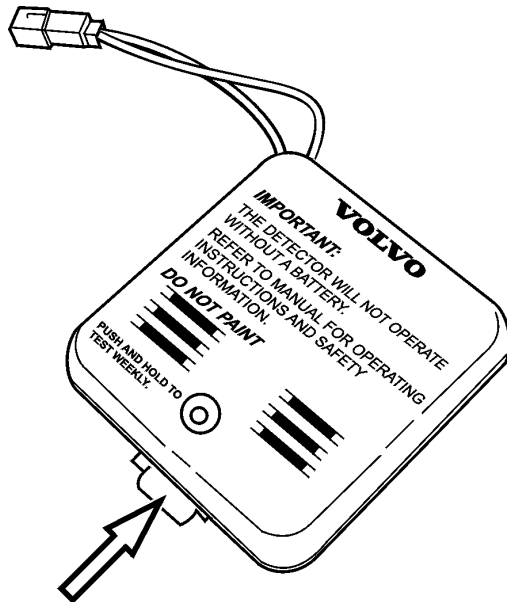
3663-03-02-01 Smoke Detector/Battery, Replacement

Removal

You must read and understand the precautions and guidelines in Service Information, group 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

1

To remove the smoke detector from the mounting base, press the release tab up. With the smoke detector removed, the 9-volt battery can be replaced.



W8002732

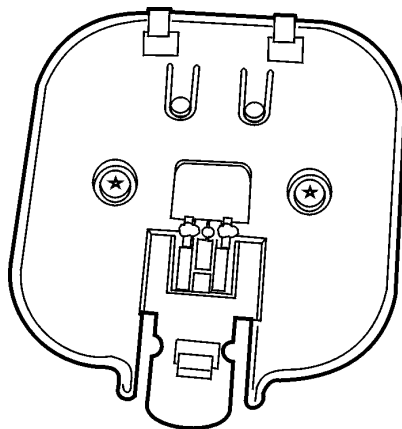
2

To remove the mounting base, remove the two mounting screws and disconnect the connector.

Installation

1

Connect the connector to the replacement mounting base and install with the two screws.



W8002734

2

Check that a known good 9-volt battery is installed in the smoke detector. Snap the smoke detector into the mounting base. Be sure the release tab is locked into position.

3

Test the smoke detector for proper operation by pressing the function button/indicator light for 5 seconds. If the battery is OK the alarm should sound as long as the button is pressed.

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3663-03-02-01 Smoke Detector/Battery, Replacement	141



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